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A Quarterly Illustrated Magazine devoted to all subjects connected with the Navigation of the Air

EDITED FOR THE COUNCIL OF THE AËRONAUTICAL SOCIETY OF GREAT BRITAIN

BY

T. O'B. HUBBARD AND J. H. LEDEBOER, B.A.

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For the opinions expressed in papers that are signed the Authors alone are responsible. None of the papers or paragraphs must be taken as expressing the opinion of the Council unless such is definitely stated to be the case.]

Notices of the Aeronautical Society of Great Britain

At a Council Meeting of the Aëronautical Society of Great Britain, held at 53, Victoria Street, Westminster, on Monday, November 8th, 1909,

1. The undermentioned gentlemen were elected members of the Society:

MR. R. W. WALLACE, K.C.
MR. J. DUNVILLE
MR. C. R. KENWORTHY
MR. PHA HTAW
MR. B. H. BALASSANIAN
MR. A. THIERSCH
DR. VAUGHAN BATESON
MR. F. L. RAWSON
MR. H. D. CUTLER
MR. H. E. HOLTORP

To date November 8th, 1909.

2. It was decided to sanction the use by members of a badge similar to the design of the crest on the Society's paper. A pattern of the badge to be kept in the Society's office for the inspection of members. The die for this badge has been kindly donated by Mr. C. Gurney Grime.

At a Council Meeting of the Aëronautical Society, held at 53, Victoria Street, Westminster, on December 14th, 1909,

1. The undermentioned ladies and gentlemen were elected members of the Society:

MR. E. W. TWINING
MR. O. C. JONES
MR. H. A. TURRILL
MR. A. CHATTERTON SIM
MR. F. J. LEDOUTHET
MISS DOROTHY PRENTICE
MR. G. G. TURRI
MR. A. B. CHEESEMAN

Major H. R. Cook, R.A.	Mr. G. B. Mann
Mr. M. Holroyd Smith	Eng.-Lt. W. B. Hall, R.N.
Mr. H. E. Holding	Mr. Jas. E. Ward (*Hon. Auditor*)
Mr. W. R. Cooper	Mr. D. W. A. Barton

To date December 14th, 1909.

2. The following appointments were made:

To be Hon. Treasurer: Col. H. E. Tyler, late R.E.

To be Hon. Auditors: Messrs. James Ward & Co.

To date January 1st, 1910.

To be Joint Editors of the *Aëronautical Journal:* T. O'B. Hubbard and J. H. Ledeboer, B.A.

To date February 1st, 1910.

At a Council Meeting of the Aëronautical Society, held at 53, Victoria Street, Westminster, on January 12th, 1909,

1. The undermentioned gentlemen were elected members of the Society:

Mr. I. Jaffe	Mr. Alex. McCallum
Mr. C. W. Meredith	Mr. F. S. Grogan

To date December 31st, 1909.

2. The Society's Bronze Medal, which is awarded annually for the best paper published in the *Aëronautical Journal*, was awarded for 1909 to Mr. F. W. Lanchester for "The Wright and Voisin Types of Flying Machines: A Comparison," which appeared in the issue of January last.

MISCELLANEOUS NOTICES

1. **The attention of members is drawn to the Supplement in this number giving the Committees, as elected by the Council, and General and Special Instructions to the same. The Council hope that the Committees will begin their work as soon as possible. It is requested that the days and times selected for the meetings of the Committees be communicated to the Assistant Secretary, in order that no dates may clash.**

2. The Council desire to thank the donors for the following books, papers, etc., presented by them:

By Lt.-Colonel F. C. Trollope (late Grenadier Guards): Some papers and pamphlets.

By Mr. P. Y. Alexander: Smoke-ring apparatus; Who's Who, 1910.

By Prof. M. F. Fitzgerald: "On Flapping Flight."

By Mr. C. Gurney Grime: Die for Aëronautical Society's Badge; "Aërodynamics," by F. W. Lanchester; "Natural and Artificial Flight," by Sir Hiram Maxim.

By Prof. Laurence Rotch: "The Conquest of the Air."

By Mr. W. H. Dines: "Contributions to the Investigation of the Upper Air."

By Mr. M. Holroyd Smith: Picture of Kestrel.

By Prof. M. K. Kasmar: "First Lessons in Aëronautics."

By Dr. Vaughan Bateson: Lantern Slides.

By Mr. C. G. Grey: "Flying: The Why and the Wherefore."

By *The Aëro:* "Model Flying Machines," by W. G. Aston.

By Dr. Hele-Shaw: "Aërial Automobilism."

By M. D. Riabouchinsky: Bulletin de L'Institut Aërodynamique de Koutchino, No. III.

Anonymous: *Ballooning and Aëronautics*; complete set; January-June, 1907.

By the Publishers: The Science Year Book, 1910 (King, Sell & Olding); "All the World's Airships," by F. T. Jane (Sampson Low).

2. The undermentioned books have been purchased for the Library:

"Histoire Aéronautique par les Monuments," by F. L. Bruel (1909).

"Bibliographie Aéronautique," by Gaston Tissandier (1887).

"L'Aviation: ses débuts—son développement," by Captain F. Ferber (1910).

"Comment on construit un aéroplane," by R. Petit (1909); Deinhardt-Schlomann Technical Dictionary in six languages, Vols. I. and IV. (1908).

3. Through the generosity of a well-known member of the Society is enabled to proceed with the publication of a series of reprints of aëronautical classics, which are now exceedingly rare and practically unobtainable. The first two volumes, Sir George Cayley and F. H. Wenham, will be published in March, and the remainder at intervals throughout the year. Each volume, which will be fully illustrated, will contain a biographical notice of the author, and his most important writings on aëronautics.

The price will be 1s. net per volume or 5s. 6d. post free subscription for the series of six. Any profit will be devoted to the Society's Library Fund.

4. The following telegram was despatched to Mr. J. T. C. Moore-Brabazon on the occasion of his flight on September 29th last, when he won the *Daily Mail* prize for the first circular flight of one mile by a British subject on a British flying machine:

"Congratulations on successful flight.—Aëronautical Society of Great Britain."

5. The following telegram was despatched to the Aéro Club of France on the occasion of the death of M. Léon Dalagrange:

"The Aëronautical Society, with profound sorrow, conveys its deepest sympathy. The loss of M. Delagrange is sustained not only by France, but by the world."

6. The Council of the Society has addressed the following public warning to the Press:

"The Council of the Aëronautical Society of Great Britain, in view of the many companies now being formed, or about to be formed, for the purposes of exploiting various types of flying machines, or for dealing generally in aëronautical appliances, consider it their duty to warn the public against investing in any such concerns without previously making thorough enquiries.

"They also warn the public against paying premiums, etc., for instruction in aëronautics without satisfactory evidence that the instructor is fully qualified to impart the same.

"These warnings are issued in the interests of the aëronautical science and industry, as well as of the general public, for it will be evident that any cases of fraud in the early stages of a new industry would seriously militate against its development and prosperity."

COMMITTEE NOTICES

The Technical Words Committee will be glad to receive any suggestions from Members as to the best terms to use in aëronautical science. Communications, which will receive careful consideration, should be addressed to the Secretary of the Committee at the Society's Offices.

GENERAL MEETING

THE FOURTH meeting of the 44th session of the Aëronautical Society of Great Britain was held at the Royal Society of Arts, John Street, Adelphi, on Friday, December 10th, 1909, at 8.15 p.m. The President, E. P. Frost, Esq., D.L., occupied the chair.

The PRESIDENT: Ladies and Gentlemen, the business of the evening appears to be, first, "the presentation of the Silver Medal of the Aëronautical Society of Great Britain to S. F. Cody, Esq., in recognition of his services to Aëronautics." I do not think—in fact I am sure that Mr. Cody requires no introduction from me. He has been in the public eye in aëronautical matters for many years, he has been a distinguished member of the Society since the year 1903, and, as you all know, he has recently so far fallen in love with this country, that we love so much, as to adopt it as his own. (Applause.) It is the policy of the Aëronautical Society of Great Britain in awarding its silver medal for practical work in flying to make a special point of the amount of experiment and research which has contributed to this end, and I am quite sure we all agree that Mr. Cody is entitled to very high consideration in this respect, for not only has he flown many miles on his aëroplane, but he invented it himself. (Applause.) Nor must we overlook another very important invention, which I have reason to believe Mr. Cody regards in even greater affection than he does his aëroplane, which has actually been adopted by the British Army, and is generally acknowledged to be the most satisfactory and practical of its kind. I, of course, refer to the Cody system of kites for scouting purposes. (Applause.) Mr. Cody was also associated with Colonel Capper in the construction and in the navigation of the first British Army dirigible, the "Nulli Secundus." Its famous voyage to London and round St. Paul's Cathedral of fifty miles or more on October 5th, two years ago, will still be fresh in the memory of most of you, if not all. We have known that Mr. Cody, like all apostles of progress, has had to face a great deal of disappointment, discouragement, and adverse criticism, and I am sure, therefore, that I voice the feeling of the Council and of the members generally when I say that it is with peculiar pleasure that we have assembled here to-night to do honour to and to celebrate the success of Mr. Cody. (Applause.) But before presenting the Society's medal I should like to call upon Major Baden-Powell to say a few words and occupy as much of our time as he can. (Applause.)

Major BADEN-POWELL: Mr. President, Ladies and Gentlemen, I am afraid after what our President has said there is little left for me to say on this matter. It has been said that we in England are very behindhand in the development of aërial machines, but, at all events, we can say that Mr. Cody has been among the first to make up some of the lost ground. And I am sure that whether he is an Englishman or an American we were all very glad to see the very practical steps he made towards solving the problem of the navigation of British air, and now that he has become an Englishman like ourselves we welcome him here to-night, and I feel sure it is the wish of all the members of the Society that we should honour him as being the first Englishman to have satisfactorily flown in England. (Applause.) Our President wishes me to occupy a lot of your time, but I am afraid I cannot do that, because, as I have said, I have so very little left to say. I will conclude, therefore, by wishing Mr. Cody continued success, and that he may still hold the lead in satisfactory flight in England. (Applause.)

The PRESIDENT: I am sure the meeting will be very pleased, indeed, if Colonel Capper will say a few words. (Applause.)

Colonel CAPPER: Mr. President, Ladies and Gentlemen, this is quite an unexpected call for me to get on my feet, but as the one person in England who has been officially in connection with Mr. Cody while he has been carrying on all his

PRESENTATION OF THE AËRONAUTICAL SOCIETY'S SILVER MEDAL TO MR. S. F. CODY

S. F. CODY E. P. FROST (President) Col. J. D. FULLERTON, R.E. (Hon. Secretary)

experiments I am very glad to be able to say a few words in his honour. He is an essentially practical man. He has got a wonderful genius, I think, for mechanics. I think that in his heart he despises theory and mathematics a little bit, and he certainly has managed to get on very well without them, but I am not sure that we could all follow his example. That sort of genius has got to be born in a man, and I think it is an extraordinary coincidence that the genius for seeing things and judging the strength should be born in anybody as it has been born in Mr. Cody without any mathematical training. It is what we can hardly any of us expect, and I think it is an extraordinary quality that the man we are here to-night to honour—it amounts really to genius—has been enabled to do what he has done, without going through the hard and strenuous training which most inquirers after truth have got to go through to arrive at it. As for his work I admire immensely the dogged way in which he stuck to it. Doggedness has always been a great characteristic of the Briton, and I am glad that Mr. Cody has become a Briton, and he will be as dogged a Briton as he was an American. (Applause.) In the early days of his experiments with the aëroplane I was myself exceedingly hurt by the way in which the Press treated Mr. Cody's efforts. (Hear, hear.) It was so very contrary to what happened abroad. The early flights of the French fliers were greeted with enthusiasm when they rose two or three feet from the ground, and then tumbled on their heads and smashed. They said: "Good old chap, go and do it again! Splendid!" But when Mr. Cody met with his early mishaps, as are bound to occur to everyone, it was really heartbreaking to see the ridicule with which his efforts were treated. A man of less energy and determination would very likely have taken it so much to heart that he would have chucked up the sponge. However, he did not, and I am very pleased to see now that the Press has understood what harm it might do by treating early efforts in this way, and has seriously considered the importance of the subject, and gives now all due honour to those who are successful and to those who are not at first successful. I could speak about Mr. Cody for a good long time. I have known him for the last few years, during which he has been associated with me, and I can assure you that I have the greatest belief in his capabilities, and I look to see him do some very fine performance before we are very much older. (Applause.)

The PRESIDENT, in presenting to Mr. Cody the Silver Medal of the Society, said: Mr. Cody, it is my privilege and my pleasure on behalf of the Aëronautical Society of Great Britain, the oldest Society in the world, to present to you the Society's medal which you have so well merited. (Great applause.)

Mr. S. F. CODY, who, on rising, was heartily greeted, said: Mr. Chairman, Ladies and Gentlemen, it is certainly very nice to hear nice things said about you but it is a thing I am not used to. (Laughter.) I do not say it to make you smile. You all know I am not used to it, because my efforts have been, as mentioned, very much doubted, that is, the *ultimate results* of my efforts have been doubted very much. As my very dear friend, Colonel Capper, says, I seem to be gifted with a certain amount of judgment. I will admit here that I have had no engineering training at all. I am not an engineer. I am a mechanic though. But I and the men of my family before me have been very, very determined people, and if I set myself a task I try hard to accomplish that task; I work at it. (Applause.) I sleep and dream about it. I worry my family more than I worry anyone else over the subjects that I study, and they, certainly with reason, grumble very much at some of my studies, because I simply pester them day and night with them; but I have accomplished my end. Aëronautics is not the first strange subject that I have taken up in my life. I was what we term a a cowboy—a crude Texas cowboy. I followed the cattle and horses, and my home was on a horse's back and always was until I bought a motor car; and I have never ridden a horse since. (Laughter.) I won't say I was a wild man ever, but there may come a man from the wilds of Borneo who will knock us all silly in aëronautics, or in any other subject he may take up, if that man is a determined

S. F. Cody E. P. Frost (President) Col. J. D. Fullerton, R.E. (Vice-President)

customer and works in the right way. I certainly appreciate very much this medal. I feel in my heart that the gold medal of this Society went to the right people also. (Applause.) Very much I agree with that, and I would like the Society to know well that when I built the Army aëroplane I had not seen the Wright Brothers' aëroplane, and I know but very little about it, although the two machines resemble each other very much now. The nickname of my machine at Doncaster was the "Papa" and the Wrights' the "Baby," because mine was so very much bigger; but the first Wright machine I ever saw was at Doncaster. I examined the curves of this Wright machine, and when I see a curve I can pretty well tell where the efficiency of that curve is in aëronautical work. The deepest part of their curve lays further back in such a way as to lift their propellers behind their machines. I don't lift the back of my machine, but I am still conceited enough to think mine is better. And I hope that I will be able to prove—I think I have proved—that I lift nearly two and three-quarter lbs. per square foot with my machine now. (Applause.) I fly it without the ailerons. I am quite prepared to take one of the head rudders off and fly it with one only. I would almost strip the machine in many ways, now I know it so well, and accomplish ordinary straight flight with it. I cannot turn it round as quickly as a little Blériot machine, but, of course, the machine was built in the hopes of carrying a Maxim gun, an officer and a driver, and to do that you must build size, I believe. I don't think a little one would do it. I may say that I was very much in hopes of using a 100-horse engine in the machine. I am still in hopes of obtaining a 100-horse engine, and if I do, I think I can promise you some good work with the very same machine. I had a slight accident at Liverpool the other day, but it was simply in running over a ploughed ground I misjudged a hedge. I shut the engine off, but I was still going rather rapidly and struck the hedge. There was no attempt to fly during the mishap. I saw that I couldn't get out of the field I had got into with the run I had and so I shut off, and I had to turn with an awkward wind blowing behind me. You will all find that out—that if you have any very high speed wind behind you it is very hard to get control out of your rudder, especially when the propellers are stopped, recognising the fact that those propellers float the blast on to the rudder which twists the machine round. Now, I frequently stop with the machine still, then switch on the current and the machine hoists round the inner side, going backward instead of forward, twists around in less than its own length. I did it at the racecourse; turned round in a space not twice as wide as the machine. I did one of the best lifting performances the day before yesterday that I have ever done since I have had the machine, since I got to a measured height of 75 feet in 200 yards, which is enormously good, I think, for a machine to do. (Applause.) My engine trouble is still worrying me, and it is the first engine trouble I have ever had. Of course, my experience with petrol engines is, like most of us, not very old, not very long. I have dabbled with them ever since they came in, that is, ever since they became popular. I hope that I will continue, or, at least, I will—as Colonel Capper says—before we are very much older, accomplish something that will entitle me to this medal, and to the honour shown me by the Society. I assure you that I appreciate the honour shown by this Society because of the age and the seriousness of the Society, and I know that it is not a Society that would do anything without thoroughly considering what it was doing I thank you. (Applause.)

The PRESIDENT: I think the $2\frac{3}{4}$ lbs. that Mr. Cody speaks of is astonishing, and an accomplishment that beats Nature—beats the birds. The next is a paper, "The Limitations of Aërial Bombardment by International Law," by Colonel Stone.

THE LIMITATIONS OF AERIAL BOMBARDMENT BY INTERNATIONAL LAW

By COLONEL F. G. STONE, R.A.

THE bombardment of undefended towns by aërial vessels has become not only the stock-in-trade of writers of romance, but is freely discussed by responsible persons as an inevitable concomitant of war between civilised (?) nations. Thus to take a single example:—

On April 21, at a meeting of the National Defence Association, Lord Montagu of Beaulieu read a paper in which he discussed the bombardment of London by air-ships, and pointed out that "projectiles filled not only with explosives, but with poisonous gases . . . would not only blow up and set on fire, but would suffocate as well"; and goes on to say: "I leave to the imagination of my hearers what effect a few hundreds of these shells would have on nerve centres such as the General Post Office, the chief telephone exchanges, the railway centres, the Stock Exchange, the Bank of England, and the other banks which closely surround it, the Royal Palaces, the Houses of Parliament, and the Government Offices, and in the most crowded streets and most thickly inhabited portions of the Metropolis."

Lord Montagu's views were emphatically endorsed by such well-known and distinguished public men as Sir Vincent Caillard and Lord Denbigh, the former Committing himself to the statement that: "We know perfectly well that during war time all means are fair." We would, however, remind Sir Vincent Caillard that although the adage hath it that "All is fair in love and war"; yet we know well, that any man who traded too freely on the former part of the adage, would render himself liable to social ostracism, and, as regards the latter part, there can be nothing more contrary to observed facts, whether we consider the code of school-boy honour, which regulates the settlement of youthful differences, or the punctilious etiquette of the duel, or, finally, the codification of the laws and customs of war, which shows a conscious desire on the part of civilised nations to play their part honourably in the great game of war, in accordance with an ever-progressive standard of humanity and moral obligation, which, so far as our experience goes, has hitherto been strictly observed. It would appear, therefore, that in the absence of any proved derelictions from the international code of honour in the past, we have no justification in assuming (as Sir Vincent Caillard does) that any nation will cynically cut itself adrift in the future from all moral obligations, on the plea that "during war time all means are fair." The bombardment of *defended* towns has always been recognised as a legitimate method of bringing about, or helping to bring about, their capitulation, and has been governed by the laws and customs of war in such a way as to minimise its horrors; these are codified in the following articles of the Annex to Convention 4 of the Hague Conference of 1907:—

Article 26.

The officer in command of a attacking force must do all in his power to warn the authorities, before commencing a bombardment, except in cases of assault.

Article 27.

In sieges and bombardments, all necessary steps must be taken to spare as far as possible buildings dedicated to public worship, art, science, or charitable purposes, historic monuments, hospitals, and places where the sick and wounded are collected, provided they are not being used at the time for military purposes.

Paris suffered more at the hands of the Commune than from the German bombardment; of the civil population only 97 persons were killed and 278 wounded during the siege ("Vinoy's Siege de Paris," p. 380).

But the bombardment of undefended towns and the destruction of private property has never been permitted by the laws and customs of war, and is expressly prohibited by the Hague Conference of 1907, under the following Articles in Convention No. 4:—

Article 23 (G).

It is particularly forbidden to destroy or seize enemy's property, unless such destruction or seizure be imperatively demanded by the necessities of war.

Article 25.

The attack or bombardment, by any means whatever, of undefended towns, villages, dwellings, or buildings, is forbidden.

Convention No. 9.

And in Article 1 of the Convention respecting bombardments by naval forces in time of war, we read:

The bombardment by naval forces of undefended ports, towns, villages, dwellings, or buildings is forbidden.

Further, at the Hague Conference of 1899, the following declarations were adopted:

Declaration 1.

The contracting Powers agree to prohibit, for a period of five years, the discharge of projectiles and explosives from balloons, or by other new methods of a similar nature.

This Declaration, which expired by efflux of time, was submitted for renewal to the Conference of 1907, in terms providing for its continuance in force until the conclusion of the third Peace Conference. It was felt, however, by many of the Powers that inasmuch as aërial vessels used for reconnaissance or any other military purpose, would certainly be attacked by every legitimate means, it was altogether unreasonable to deprive them of the means of retaliation, and nearly all the Powers except Great Britain, the United States, and Austria-Hungary declined to ratify. At the same time, it was felt that the use of projectiles and explosives by aërial vessels, must be confined within the same limitations as govern their use by land and sea forces, and the insertion of the words: "by any means whatever," in Article 25 of Convention No. 4, was held to provide sufficiently for this; this was agreed to unanimously by the great Powers.

Declaration 2.

The contracting Powers renounce the use of projectiles, the sole object of which is the diffusion of asphyxiating or harmful gases.

This Declaration, made in 1899, remains in force until denounced. A year's notice is required of the intention to denounce any Article of the Conventions of the Hague Peace Conferences.

It must be admitted that the Powers are unanimous in refusing to allow any license in aërial warfare, which is not permitted in land or sea warfare, and that it is clearly their intention to prohibit bombardment, except as a means of breaking down the resistance of a defended town or of destroying an enemy's warlike personnel or material. Thus it would be legitimate to bombard Portsmouth from aërial vessels in conjunction with an attack by sea or land, or both, against the defences; but it would not be legitimate to bombard Southampton. It would be legitimate to bombard Aldershot Camp if troops were lying there, and the town might suffer incidentally from its proximity to the Camp. Again, it would be legitimate to bombard Woolwich Arsenal, and in this case, also, the town might suffer incidentally. But when we come to consider London, we cannot admit that it is a "defended" town in the sense that Portsmouth is, or in the sense in which we believe the Plenipotentiaries at the Hague Conference used the term. True, there are forts at the mouth of the Thames to prevent the ac-

cess of an enemy's warships to the Docks and City of London, but it would be a strained interpretation of the intentions of the Powers to admit that if warships were attacking Chatham and Sheerness with a view to facilitating their undisturbed progress up the Thames, it would be justifiable at the same time for airships to bombard Cheapside with a view to creating a panic, on the plea that London was "defended" by the guns at Chatham and Sheerness, and therefore liable to bombardment in conjunction with an attack on those places. The intention seems clear that it would be justifiable to bombard the town of Chatham if such a proceeding were in any way likely to facilitate the capture of its defences, which, however, we cannot admit to be the case.

Apart, however, from the fact that bombardment of undefended towns would be an act of sheer barbarism, there is another aspect of the case. Would it be worth while? Mr. Mond, the Liberal Member for Chester, put this view of the question very clearly in the discussion which followed Mr. Haldane's statement to the House on the subject of airships for war purposes, on August 3. The Hon. Member said: "It was unlikely in these days that one nation would attack another by blindly scattering explosives about undefended towns. No nation would make peace simply because the enemy was killing its civilians."

Lord Balcarres, Unionist Member for Chorley, Lancs., who followed, did not share "the optimism of the Hon. Member. . . . If the Hon. Member was right in saying that no civilised country would ever use airships to drop explosives on an unfortified town, was it too much to ask the Government to make enquiries among the other Powers of Europe with a view to agreeing at the next Geneva (? Hague) Conference to a clause providing that airships and explosives should not be used in that way? If the Powers did not mean to smash civil property in time of war, they would not object to such a proposal."

It may be admitted that the distinction between an "undefended" as opposed to a "fortified" town lacks definition under modern conditions, and that in this lack of definition lies a possible danger.

It would be a distinct gain to civilisation if the next Hague Conference would introduce an Article into the Convention regulating the laws and customs of war, somewhat to the following effect: That no bombardment of any sort, whether by land or sea, or from aërial vessels, shall be permitted against any place or locality, except for the purpose of destroying its defences or defenders, or the war material contained within its boundaries.

The PRESIDENT: This is an extremely interesting and important paper, by Colonel Stone, that I am sure it will evoke a most interesting discussion not only from military men, but from other members. If any gentleman will send up his name we shall be delighted to hear what he has to say.

Colonel CAPPER: Mr. President, the paper that Colonel Stone has just read is, I think, one of the very greatest importance. The question of the dropping of explosives from airships wants, as he said, to be put on a very, very clear footing. To my mind the question is at present exceedingly obscure. The whole question turns on this, I think, on what principle was that Hague Convention made which forbade the dropping of explosives on undefended towns? I think that it is on the principle that it is not fair to hit a man who cannot hit you back, and that there is no other principle whatsoever. That is the general principle in war of sparing civilians. You spare the people who are doing you, and can do you, no harm. If they harm you by spying or in any other way you treat them as beyond the pale of war; you destroy them by hanging or any way you like without even a trial, otherwise you confine your fighting to those adversaries who are able to hit you back. With regard to the question of the fortification of a seaport, the ships that come to bombard that seaport have presumably to run the risk of the enemy's guns defending it. They run very serious risks, and on account of those risks the custom of war lays down that they may do damage. It is the same principle on which the old custom holds—I don't know whether

it does or does not hold now—that when you were attacking a fortified town and had made three workable breaches in the fortifications you could call on the garrison to surrender; and if you had to take that town by assault the garrison forfeited their lives, because it would cost you such a great loss of life in order to take that town. A foreign nation at war with us would presumably send its airships over England. Its main object may not be the destruction of property, it may be it wants to get information. Against such an airship what is and what is not an unfortified town? All towns are fortified. The lecturer instances that it would be perfectly legitimate to drop explosives on Aldershot Camp if there were soldiery there. I presume that in every town in England there will be soldiery, the Citizen Defence Army, and every one of those soldiers, with a rifle, is capable of doing infinite damage to that airship should it come within easy range. They can shoot at it if it comes low enough down and kill the crew. They might, with success, blow it up. People might fire rockets at it. It runs the risk of destruction every yard it goes. If it is shot at from the neighbourhood of a town there is not the least doubt, in my mind, but what it will make a reprisal, and to my mind those reprisals will be perfectly legitimate. You cannot expect the airship crew to run the risk of instant destruction at any moment without making the most serious reprisals should any effort whatsoever be made to destroy them. That is a danger that we have got to guard against, and I do not see how we can guard against it. It is a most serious question to my mind, that interpretation of the fortified or undefended towns as against an airship. As against an army, as against a navy which can only move in one plane, the thing is clear enough. Supposing there were hostile cruisers off Brighton, and a single 4.7 or 5 in. gun was located there, and some patriotic gentleman chose to fire that off in the middle of the esplanade at one of those enemy's cruisers, I think the chances are that the cruisers would fire back, and they would not confine themselves to caring whether they hit the gun or not, they would fire back indiscriminately at the town. Just on the principle as when the Germans in France were fired on by the franc-tireurs from the neighbourhood of a village, it was the village that suffered. It is no use saying they were harmless civil inhabitants. They burned the village and they would not suffer their own men being killed, and they will do just the same again—any nation will, I think—ourselves included. Unless it is distinctly and firmly laid down and understood by these conferences that either the airships are to be unarmed and may not fire down at all and no one on the ground may fire at them, until you make it fair for both sides, to my mind, you would always have this risk of reprisal staring you in the face. There may be people in command of the airship and air fleets who will only be too glad to have an excuse for doing damage—they will say: "No, we don't want to, but it was forced on us"—and if such reprisals tend in any way to destroy the wealth of the country, to destroy the sinews of war—who can say what may not be the sinews of war in these days—this will be an advantage which very few nations will like to forego. (Applause.)

Major Baden-Powell: Mr. Chairman, Ladies and Gentlemen, I have not very much to add to this discussion. I can only say how very interesting it is to hear two authorities such as we have to-night discussing such a matter, and it also seems to me to tell a great lesson to those who very often speak ignorantly on such subjects. Lord Montagu very probably intended to do a great service, as I have no doubt he did in many ways, by reading a paper on the subject of aërial bombardment, but, of course, it is not a subject that he has made any study of, and, therefore, he is rather liable to, what is vulgarly called, put his foot into it. And, of course, a great many others have done the same in making certain statements which are not in accordance with what is known to the more technical authorities. There is just one point which has always puzzled me in these international laws prohibiting the discharge of explosives from an aërial machine, and that is how to define an aërial machine. For instance, the idea has often been suggested and, I believe, even experimented with, of sending up small balloons without people in them. In fact, it was tried in actual warfare a great

many years ago at the siege of Venice, I believe. A number of small balloons were sent up with explosives and with time fuses or some such arrangement, to drop the explosives on the town. Now, are those to be considered outside the law which prohibits discharging explosives from aërial machines? And, of course, if we say that that is so, then we come to various other instruments even less like an aërial machine, such as some form of rocket. It has been suggested to have a winged rocket which could travel long distances, and which is practically nothing more than a model aëroplane, so that it seems rather a question of whether you have got men in the machine or not; and that is not a very distinct definition, because men might land at some place near and start the machine to go over the town or whatever it is. In fact, there is no drawing a hard and fast line with such machines. Although, as I say, definitions might be made that way, still it is one of those little difficulties which ought to be got over. (Applause.)

Mr. Reid: Mr. Chairman, Ladies and Gentlemen, there are so very many interesting points suggested by Colonel Stone's paper that one could really start a very long discussion on it, and I think we should have to to do it justice, but time presses, and I think we ought only to deal with the chief points this evening. But there is one thing that I think Colonel Capper has voiced as plainly as anyone could voice it, and that is that if war breaks out practically the whole of the country is hostile, and is treated as hostile. I do not think there is any question at all about that. In the last war of our own we did it ourselves. In the Transvaal we treated the whole population as hostile in certain districts, and if we did treat them humanely it was, perhaps, because we are not utter barbarians—we English; but some of our friends on the Continent certainly considered us barbarians because there was a certain amount of mortality in the camps that we instituted. Again in the Franco-Prussian War the French, whenever they got the chance, shot at any Prussian soldier they could see in certain districts, regardless of the consequences. A man felt patriotic, and he felt that an invader was in his country, and he shot him. I lost a very dear friend. I was in Germany at the time, and he was called to the war, and he was shot by a franc-tireur. The Germans called his slayer a murderer, and the French called him a patriot. I think when people really are at war paper guarantees are of absolutely no use whatever. There is no public opinion that is able to enforce any laws at all on whatsoever nations are at war. (Applause.) The only public opinion that counts at all, and I think that is the public opinion that is the most powerful in civilised nations, is the opinion at home. If our troops go into a foreign country and it becomes known through our Press that they are killing defenceless civilians, the Government would not stand for a day. It would have to be stopped. It is the public opinion in the nation to which the army belongs that is more powerful than any opinion of foreign nations. That is my opinion, and I have studied the matter. There is no executive, in fact, to enforce the law, and you cannot imagine the law without an executive to enforce it; it is useless. With regard to the use of aërial torpedoes, when torpedoes were first invented there was a great outcry against them; they were thought to be unfair, and there was a great talk of prohibiting them. The same took place after the invention of gunpowder. Those who have gone into the history of those times find that all the knights and the people of armour complained against gunpowder. It was not manly. It was, as Shakespeare said, "villainous saltpetre." We have got beyond the saltpetre days; our explosives do not contain saltpetre now. But I do think this, that the time will come when balloons or aëroplanes will be the recognised instruments of warfare, and we really must face the question how to deal with them. We cannot do it on paper, we must do it practically. If we are to guard ourselves from aërial torpedoes within this country we must do it by other aërial torpedoes. With regard to the damage they may do, I think that has been very much over-rated. I think Major Baden-Powell has rightly hit the nail on the head when he says that many of the statements made with regard to the damage which may be done by dropping explosives upon cities have been greatly exaggerated. I have some authority for speaking on the subject, because I have

had considerable experience in these matters—not in dropping the explosives, but I have made many thousands of tons of dynamite and gun-cotton, and I started the smokeless powder industry, and, therefore, I think I can speak with some degree of knowledge on the damage that might be done by a certain amount of explosives that might be dropped upon a town or a fortress. The radius of damage is extremely small. If you were to drop, say, a ton of dynamite on to a building there would be very little structural damage done outside a very small radius. You would have windows broken, but they are not heads, neither are they buildings. I do not think that the damage would be very serious as regards the actual destruction, but, of course, the damage done to persons might be very great if an aërial machine were to go over Buckingham Palace, for instance, and drop explosives there. If it could ever get there that might be a very serious matter. But I think it has been found in every case almost that means have been found ultimately to combat every weapon that has ever been invented. We have got our ironclad that still keeps shells out; although there has been a battle for many years between the projectiles and the armour plating, yet the armour plating still maintains somehow or other to keep the shells out. And in the same manner, I think, we shall as very quickly raise an aëroplane that will be able to deal with an enemy's aërial fleet the moment it comes within the horizon. And then we must remember that we have very, very swift means of communication nowadays. If an aërial fleet were to appear on the shores of the Channel, within half-an-hour all England would know it. We have got the telephone, the telegraph, and we could send the news even by wireless telegraph over the whole country within a few minutes. All the aërial ships that we must have—we have not got them now, but we must have them, and we must have them as soon as we can get them—(hear, hear)—all those ships will be available. Now, the position of an invading force of that kind is rather an awkward one. If the air is clear they might do damage, but they would be seen even at night. You *could* see such a thing. If the air is foggy or misty they cannot see where they are going, they could do no damage at all, and they must wait till it clears up. Therefore, they are in this predicament, they are coming away from their base, they have got a limited radius of action, and let us hope we shan't all be asleep. I think in the time when the Armada came to England they thought they were going to have an easy job of it, but we were not quite asleep then; and I think the same will be the case if our Government will only vote a small fraction of the amount of money that is spent on national defence to the most urgent problem of the future in providing the means for keeping out of our country enemies that may otherwise very easily get in. (Applause.) The point which I would emphasize by these remarks is that wherever an aërial vessel of that kind comes into a foreign country it is a forlorn hope. Its crew risk their lives. You will find men that will risk their lives if they can damage the enemy—there are always patriotic men that will do such things, as we have seen in the Russo-Japanese War, but they risk their lives and they have very little chance of getting home again. (Applause.)

Mr. S. F. Cody: Mr. Chairman, Ladies and Gentlemen, I think this last speaker touches slightly on my part of the study, that has been my part of the study ever since I took up aëronautics. My part of the aëronautical study is to produce an engine of war, and always has been. I have never hoped to make a sporting article nor a commercial article other than carrying special messages by post—for postal service in warfare. I do not think that the aëroplane will ever become a weapon for great armies to besiege another country at all. I think they will be excellent to harass, to aggravate a commander, a man in charge of a big force. For instance, I haven't been a soldier of war much; I have had little skirmishes with Indians, and they are very keen fighters, very, very shrewd. I can imagine how easy you would take them to destruction by sending an airship from ten miles behind your line over your head to attack retreating or advancing cavalry. What a terrible position the man in charge of the cavalry would be in if there were an airship above him so high that they couldn't fire at it, and they were

popping away with only .22 guns, one of which would kill the soldier or break the spine of a horse's back. If you were to fire ten thousand rounds out of an aëroplane in very quick succession with one of these small weapons, or we will say a .303—something like a Mauser, a very small weapon—and a small bullet which would gain force as it came down and would need a very little charge of powder behind it, the aëroplane would be valuable, in my opinion, not only for reconnoitring services. It will never be worth twopence for bombarding purposes. I do not think myself it will ever be any good at all because, as our friend says, you might drop ten lbs. of gun-cotton within twenty feet of a man, if a man was lying down on soft ground, and it would not hurt him possibly, because the gun-cotton may blow a big hole in the ground and not hurt the man at all. I have had a little experience with gun-cotton, because I stole my gun-cotton to blow up rocks from mining people in the district where I was a boy—it was like stealing apples—it was my own father's gun-cotton that I used to steal. I think that airships and aëroplanes will be a very valuable article to harass an enemy, and not to do actual personal damage to the force at all. I know that I am quite prepared to go up in a flying machine, and I will guarantee throwing glass balls from the flying machine and breaking them before they get very far away from me. And also I think I could go 500 or 600 or 1,000 feet above a tent and put some hundreds of shots into it with a Maxim before I passed over it, going at the speed of 40 or 50 miles an hour. Or, if cavalry were advancing or retreating and I could spot the leaders of that cavalry, I think I could make very mischievous work flying over them. If I lost my life I might help to win the day, and that is every soldier's duty to put his life in his hands; indeed, he has to, I consider. So I think the aëroplane is going to be a very valuable engine of war, used in the right way. I know I am not a soldier, but I think, if I had the aëroplane and was allowed to conduct it in my own way at the right moment, I would do some mischievous work with it. (Laughter and applause.)

Mr. Percival Spencer: As the owner of several airships I think I might be permitted to say a few words—very few—in connection with the use of airships for bombarding London particularly. In flights which airships make, it is, I know from experience, very difficult, indeed, ever to strike a particular object which you wish to. There is no doubt about it with the developments of airships that we see, it is only right that we in this country should maintain a series of such vessels in order to be on a par with those that have been made on the Continent, and no doubt we shall advance to that extent. Already at the present time we have two in our works in Highbury, and have also fitted a gas vessel for a smaller one that is giving rather successful flights in Cardiff at the present time, and I am simply rising to my feet to suggest that the use of airships for other than military purposes may not be entirely forgotten. Most of our speakers, of course, following the able paper of Colonel Stone, have dealt upon the military airship, and, in fact, it has been our distinguished military members who have spoken mostly to the point. Still, there is no doubt that there are extensive uses that we, as the members of this Society, look to the airships to carry out beyond military purposes. I have very little to add. With regard to the practical blowing up of London by airships I think, as Major Baden-Powell pointed out, there may be more in the thought than in the actual carrying out, because there is a great difficulty ever to come here, and when they are here, there is the fact that I first mentioned, the difficulty of actually hitting what you attempt to. Our member, Mr. Reid, pointed out that even a ton of dynamite is not calculated to do irreparable damage. Taking into account these facts, and also the insular position of England, where wind springs up to drive any airship or aëroplane miles out of its expected course, I think, possibly, we shall find our greatest friend, as in the case of the Spanish Armada—strong south-west winds—may be our greatest protection against these formidable weapons. (Applause.)

Colonel F. G. Stone: Colonel Capper has enlarged on the danger of offensive action from land bringing about reprisals from an airship. This danger, of course, is an obvious one, and one with which we must count, and it is partly

owing to the presence, the imminence of this danger, that I was anxious to bring this question before an educated audience with the view of getting as wide a public discussion as possible, because unless the country, as a whole, is educated with regard to the bearing of the laws and customs of war as affecting this particular question, the danger which Colonel Capper foresees will be an ever present one and may result in giving that opportunity to, I won't say an unscrupulous enemy, but an enemy which does not mince matters, to take the very first chance they have of bombarding by means of their airships an area which would otherwise remain absolutely untouched. Probably most of us here present saw the play, "The Englishman's Home." I think that that play struck us soldiers probably very much more closely than it struck the majority of civilians, unless those civilians had some experience as volunteers. The play to me was intensely realistic. It was the most realistic thing I have ever seen in England. As a nation we are not very good at absolute realism on the stage, certainly not so good as they are in France, and never in the whole course of my experience have I seen on the stage in England anything so intensely realistic and educative as that play. You will remember that the position was somewhat the position which Colonel Capper brought before us—a civilian firing a rifle; he had no right to fire that rifle, he was not a soldier, he was not enlisted, he was not in uniform. He was doing what the franc-tireurs in France did when they brought about reprisals on the part of the Germans. The Germans did not break the code of international law. It was the French franc-tireurs, irresponsible people, without any possibility of doing any good to their country, without any possibility of driving the enemy out, but filled with an unreasoning patriotism, not an educated patriotism, who fired under the garb of a civilian a treacherous shot which brought down the inevitable reprisal. That is not cricket, and the French found to their cost that they had to pay the piper. I do not think that anybody who studied that war carefully will say that the Germans exacted any excessive punishment for the provocation which they received. (Hear, hear.) It is of vital importance to us as a nation, or it may be that we as a nation should understand what the meaning of international law is, what the customs and laws of war are, and that we should not put ourselves in the position which the franc-tireurs in France did, and which our friend on the stage in "The Englishman's Home" did. It can do no good to the country. If we wish to defend our country we must make the sacrifices now. I could say a great deal on the subject, but being an officer on full pay my mouth is closed, but you will readily understand what I mean, which is that no one is justified during a campaign in firing a shot in anger at the enemy unless he is an enlisted soldier, and if he does so, he brings about the most fearful reprisals which damage his cause, damage his country, and do absolutely no good whatsoever. I am very glad that Colonel Capper brought that point out, because that is the very question I want to see thoroughly thrashed out throughout the country in penny papers, halfpenny papers, and absolutely in every village, so that everybody may understand that one ignorant yokel firing a shot may bring disaster upon his village or his town. (Applause.) Major Baden-Powell raised rather a curious point, which seemed to be the question of whether the aërial vessel carried a crew or not would affect the question which I have brought up in my lecture. I am not quite sure whether I understood him correctly—perhaps he will enlighten me if I make a mistake—but it seems to me it does not matter tuppence whether the aërial vessel carries a crew or whether it does not, but is being used as a weapon of war. The question of bombarding an undefended town by means of that vessel scarcely depends upon whether that vessel carries a crew or whether it does not.

Major BADEN-POWELL: I was not necessarily referring to an undefended town, but I think in the Hague Convention they spoke of aërial vessels being used in warfare for dropping explosives without stating whether it was against a fortified place or not, so that there would be a question of whether such a purpose as suggested—sending a small balloon to fly over a town to drop explosives—would be included under that heading.

Colonel F. G. STONE: Yes, I take it that the kind of aërial vessel mentioned by Major Baden-Powell comes under exactly the same category as an aërial vessel carrying a crew. But no doubt very careful definition is required, and possibly we may hope that at the next conference the whole of this subject will be more thoroughly thrashed out than it has been hitherto, and we may obtain more clear definitions, because I take it that all Powers are more or less aiming at the same object, and, therefore, we may hope that we shall arrive at a satisfactory conclusion. The great thing is to know where we are, to know what the offence is. Mr. Reid drew a parallel with the conduct of our troops in the Transvaal with respect to when two Powers are at war, each Power regards the whole of the enemy's territory as being hostile. I think that is correct. As regards this parallel I do not think that Mr. Reid was quite justified in drawing it in the case of the Transvaal. I was in South Africa myself during the war, and I think that the only criticism which could be passed upon the conduct of the military operations in South Africa as a whole was that we did not sufficiently treat the inhabitants as hostile. (Applause.) Anything more absolutely merciful and friendly, magnanimous—I think some of our critics even said idiotically sentimental—I have never seen in the whole course of my life. We were imbued with one feeling which was that in this unfortunate war we were fighting with people whom we should have to live with when the war was over. It was not the invasion of an enemy's territory, the exaction of an indemnity, and then clearing out. I had the privilege after the war was over of serving in a civilian capacity for fifteen months in the Transvaal, helping to clear up the mess that we had made. The friendly feeling of the Transvaalers, of the Generals—many of whom I knew intimately—of nearly all the Boer leaders towards the British officers was something so remarkable that I only wish everybody in England could have shared the experience I had. As to treating the territory in South Africa as hostile, I do not think that it ever entered the head of any officer or soldier in the British Army to do so. The only occasion on which some little licence in this matter occurred was in Cape Colony where there was a great deal of bad feeling between the Cape Colonials and the rebel Cape Dutch, which was very natural—I do not mean that the feeling was natural. But in the Transvaal it was non-existent. We were fighting a fair enemy in a fair field, and the friendly feeling both before and after the fight was something which, perhaps, very few people who were not there could possibly realise. Colonel Capper was there, and I am sure he will bear me out.

Colonel CAPPER: That was so.

Mr. REID: I hope Colonel Stone will not think, and I hope no one in this room will think I said a single word as to the conduct of our troops in the Transvaal. It was very far from my thoughts to do so, but I think it was a necessity for carrying out their operations to treat the population as hostile. I was referring to the camps in which, I think, every humanity was exercised, but the population had to be collected in camps and taken away from their homes and treated as being hostile to us. I won't say that the women and children actively opposed us, but it was a necessity of our warfare, and we did not bring the campaign to an end until that was done.

Colonel F. G. STONE: The women and children did oppose us, as a matter of fact, and we treated them with the greatest leniency, but we had to segregate them in camps to prevent them doing it again. I make a point of this, because I think the Transvaal was brought up as an instance, and I think it is an instance rather against Mr. Reid's argument than in favour of it. It was so essentially a case where we did not make war against the inhabitants, and we treated them with the greatest kindness and friendliness, and, therefore, I do not think that it quite bears out the argument which Mr. Reid on general grounds wanted to bring forward—that when two nations are at war they regard the whole territory of the enemy as hostile to them—that was the point that I wished to make in answer to it. Mr. Reid again says with great truth that public opinion is the

principal factor in limiting any licence on the part of the military leaders in connection with the inhabitants of the country with which they are at war, and instances the French franc-tireurs who were shot at by the Germans. I have already mentioned that point, and, as I say, my own opinion is that the French were treated with extraordinary forbearance in many cases, but certainly in no case was the action of the Germans not justified by the provocation they received. The point is that the French were the people who started the ball rolling. If the French non-combatants had remained non-combatants and not treacherously shot at German soldiers under the guise of their civilian clothing, there would have been no reprisals at all. Mr. Reid also mentions that the damage done by aërial torpedoes is much over-rated. In this he speaks as an expert, and I as an artillery officer have the greatest pleasure in absolutely agreeing with every word that he says. The action of high explosives is very, very much over-rated. It has always proved a disappointment. It was a great disappointment to us in the Transvaal, where we found that lyddite shell did comparatively little execution, owing to the extraordinary local action of the explosive. They didn't destroy the enemy's trenches in the way we hoped they would. The Japanese had the same experience with their very much vaunted high explosive powder, which absolutely shattered everything to dust within a radius of a few feet, but did very little harm when it came to a question of yards. High explosives, to be really effective, require to be confined in a close space. Mr. Cody went rather beyond the scope of the lecture, and at the same time I was very pleased to hear how sanguine he was with regard to the use of machine guns from aëroplanes. I hope he may be one of the first in England to carry a machine gun in his own aëroplane. (Applause.) The last speaker admits the difficulty of hitting a target from an airship, and enlarged on the general uses of airships. With regard to the general uses, of course, this is outside the scope of the lecture, which is a lecture on international law. But I may say, as a gunner, I am not at all sanguine about the facility of hitting a small target by discharging anything from an airship. I think myself that it is a question which is a very long way from being solved at present and will require very careful experiment, very great application, and the expenditure of a good deal of money before we arrive at any conclusion as to what we can do and what we cannot do. There is one danger which has not generally been alluded to, which I brought up more than a year ago—a question which Colonel Capper himself has constantly thought of—and that is what damage will the explosion on the ground of a bomb do the airship which discharges it, having regard to the height at which the airship is above the place where the explosion takes place. It is a technical question nothing to do with the lecture, and I merely mention it as it has been brought in by the last speaker as something to think about. It won't be all beer and skittles to the airship which discharges a bomb at close quarters. (Applause.)

The PRESIDENT: We have had very valuable opinions both military and civilian, and our thanks are due to Colonel Stone for his most interesting and instructive lecture. But I fear, in spite of all international agreements, it will be, in the end, the survival of the fittest or the strongest. As a civilian I earnestly hope that aviation in its preparation for war will work for international peace amongst the Powers. I will call now upon Colonel Fullerton for his paper, which will doubtless be of great interest to the members generally, and it is thought that their opinion ought to be of much value. The subject matter of the paper will be dealt with at the next Council meeting of the Aëronautical Society.

THE FUTURE WORK OF THE SOCIETY

Some Suggestions

By COL. J. D. FULLERTON, R.E. (RET.)

Mr. PRESIDENT, LADIES and GENTLEMEN,—As I have now had two years' experience of the working of the Society, as its Hon. Secretary, it may, I think, be advantageous if I lay before you some suggestions regarding the work to be done by the Society in the future.

You will, of course, understand that the views I express are personal ones, and that I do not pretend to give you the opinion of the Council, as a whole, on the matters referred to.

2.—THE GENERAL POLICY OF THE SOCIETY

By our Rules the Society exists for:

> "The purpose of giving a stronger impulse to the scientific study of Aërial Navigation, to promote the intercourse of those interested in the subject at home as well as in different parts of the British Empire and abroad, and to aid with advice and instruction those studying the subject."

I think it is most desirable that we should continue to work upon these lines. The Sporting and Propaganda branches of Aëronautics are no doubt of great interest to many of our members, but these branches require, in their way, just as special knowledge as the more scientific work does, and, in my opinion, it would be a very serious error if we departed from our original policy and attempted to include them in our programme.

Our work is to develop the scientific side of the subject, to help our members to design their machines on scientific principles, and to save them from that waste of time, money, and energy which at present so frequently occurs, by giving them the best possible information regarding aëronautical science.

This programme, I believe, contains everything that the Society can properly carry out, and I am strongly opposed to any enlargement of it.

3.—THE COUNCIL

During the present year the work of the Council has increased enormously, and I think it is now time for some arrangement to be made to assist the members in their duties. All our members of Council are very busy men, and while they most kindly do everything they can to help the Society by attending Council meetings, giving advice on important matters, etc., it is clear that some steps must now be taken to facilitate further the carrying out of the Society's business. The number of members of Council might, of course, be increased, but I think the best plan would be to form a "General Purposes Committee" (see below) to report upon the various questions which now come up for consideration. Such a Committee would be of great assistance to the Council, and its formation would also, I think, be popular among the members of the Society generally.

4.—THE HON. SECRETARYSHIP

During the forty-three years the Society has been in existence its general management has for various reasons been largely in the hands of the Hon. Secretary for the time being.

The duties are, however, getting too heavy for one man to perform properly, and I think that new arrangements should be made.

An Hon. Treasurer should be appointed (aided by a Finance Committee, see below) to carry out the financial duties, an Editor, assisted by a Reading Committee, to manage the Journal, and the remainder of the work, such as the office

work, Library routine business, etc., should be entrusted to an official called "The Secretary of the Aëronautical Society of Great Britain." These three officials would all work under the direct orders of the Council, and I believe such a system would be efficient and conduce to harmonious working.

5.—THE HON. TREASURER

With some slight alterations the duties of the Hon. Treasurer would be those already laid down in the Rules. The routine work in connection with the accounts would be done in the office, but the actual control of the financial arrangements would, of course, be in the hands of the Hon. Treasurer, assisted by the Finance Committee (see below).

6.—THE SECRETARY

The duties of the Secretary would, naturally, be very similar to those now performed by the Hon. Secretary, but he would not be in charge of the financial arrangements, and the editing of the Journal might, with advantage, be done by a Special Editor.

7.—THE MEMBERS GENERALLY

There are a number of ways in which the members can assist the Council, such, for instance, as helping to get new members, working actively on the Committees, assisting financially, reviewing books, magazines, etc.

As regards new members it is, I think, desirable to increase the membership of the Society to, say, 1,000 or 1,200 members, and if each of the present members would get one or two new ones we should soon reach the strength which, in my opinion, is about the limit for a scientific society.

Active work on the Committees assembled from time to time is also very desirable, and I hope members who can spare the time will assist us in this way. I particularly wish to point out that the fact that a member cannot attend many Committee meetings is not necessarily a bar to joining a Committee, as the bulk of the work done in cases of this kind must be done in a member's spare time, and the results of his labours can always be communicated to the Committee by post. Financial assistance is, of course, very much wanted. Scientific work is expensive, and it is greatly to be hoped that members will either themselves assist the Council in this way, or get their friends to do so.

8.—ASSOCIATE MEMBERS

It has often been suggested that the Society should have an Associate Class. I think the time for this has come, and that we might have two classes of Associates, each paying ten shillings and sixpence per annum. The reason why I suggest two classes is that the conditions which would suit an Associate living, say, 100 miles from London, would probably not be suitable for one living in London, and that variable terms suited to, say, Town and Country Associates, would probably be more likely to attract suitable men.

9.—COMMITTEES AND THEIR WORK

As it is impossible for the Secretary to carry out all the scientific work of the Society I think the number of Committees, especially those dealing with technical matters, should be increased. A detailed list of these Committees is given below, but a few remarks applying generally to all of them may not be out of place here.

All Committees should have a fixed time for meeting, say once a month, or more frequently if considered desirable. The Council's instructions to the Committee should state clearly its objects, etc., and inform the Chairman of the amount of the funds placed at his disposal. The Committee should prepare a definite programme of work, distributing the actual work among Sub-Committees or individual members as may be found convenient, the reports of the results obtained being forwarded to the Council.

Working on these lines I believe that an immense amount of useful information could be collected, and its publication in the Journal of the Society would, I think, be of great assistance to the members and the general public.

10.—THE JOURNAL

The Journal should, I think, be carried on much as at present, viz., as a Quarterly Scientific Journal containing all the best available information regarding Aëronautical Science. The principal topics dealt with would, naturally, be scientific experiments, details of machines of various kinds, criticisms on aëronautical subjects generally, reports of work done by Committees, etc. Reviews of books, journals, etc., should also be included, as it is most desirable that members should have put before them summaries and reviews of the best aëronautical literature.

A Reading Committee, to which certain papers sent in might be referred, would, I think, be an advantage in some ways, but, perhaps, the time has not yet come for a Committee of this description.

The Editor would, of course, do all the work done, till now, by the Hon. Secretary, and would be generally responsible for the publication and advertising.

11.—THE GENERAL PURPOSES COMMITTEE

As explained above, it is desirable to have a Committee meeting, say fortnightly, or as found convenient, to settle numerous minor matters which cannot be very well dealt with by the Secretary.

I think such a Committee might consist of a member of Council as Chairman and eight members elected by the whole of the members of the Society. A good deal of very useful work could be got through by a Committee of this kind, and while its proceedings would, of course, be subject to the approval of the Council, practically speaking most of the questions requiring consideration would be settled by it. The Secretary of the Society would act as Secretary, and it might be an advantage to make members of Council ex-officio members of the Committee.

12.—FINANCE COMMITTEE

I think this should consist of the Hon. Treasurer as Chairman, a member of Council, and one member elected by all the members of the Society. Its chief work would be to discuss and examine financial proposals, and to assist the Hon. Treasurer generally in his duties.

13.—EXPERIMENTAL GROUND COMMITTEE

This Committee was formed at the beginning of the year to take charge of the Experimental Ground. It has done a great deal of work, but the bad weather throughout the summer has prevented much use being made of the ground. It is hoped to improve matters shortly, as one member has kindly offered the Society the use of his ground gratis, and another has suggested helping the Society by making certain other arrangements which cannot at present be detailed. The whole question is now being carefully considered by the Council, and the result of their deliberations will be communicated to members at an early date.

14.—LABORATORY COMMITTEE

This is probably the most important of all the Society's Committees, and I consider that the success of the Society in the future will depend very largely on the work done by it. Hitherto the very limited amount of funds at our disposal has prevented our doing much research work, but owing to the generosity of a member we now have funds available, and, with care, it will be possible to commence some very useful work as soon as the Committee assembles. I desire to make a special appeal to members and all people interested in Aëronautical Science to assist this Committee with grants or contributions, as the apparatus employed is costly and cannot be provided from the ordinary funds of the Society.

15.—THE LIBRARY AND MUSEUM COMMITTEE

As laid down in the Rules this Committee consists of the President, the Secretary, and a member of Council. But it would be a great advantage if we added two extra members to it, as there is a great deal of work to be done in classifying books, papers, lantern slides, etc.

During the coming year I think an extra room should be taken as a model room, where the Lilienthal and Pilcher machines and the models recently purchased by the Society could be exhibited, as our present room is too crowded to allow machines of this kind being shown.

May I say here that the Library Committee is always glad to receive aëronautical books, papers, models, lantern slides, etc., for the use of the Society, and I hope members will assist us by presenting them.

16.—COMMITTEE FOR THE CONSIDERATION OF INVENTORS' PROPOSALS

One of the objects of this Society is "to assist with advice those who are studying aëronautics," and, consequently, this Committee is a very important one. Many inventors are anxious to get a confidential opinion on the merits of their schemes, and carefully worked out reports by members who thoroughly understand the subjects submitted to them, would be of great assistance in cases of this kind. The Committee might meet, say fortnightly, and its great object should be to explain clearly the good and bad points of any proposals laid before it, and thus save inventors from wasting time, money, and energy on schemes of doubtful utility.

17.—TECHNICAL WORDS COMMITTEE

As is well known, there is an immense amount of confusion at present in what may be called aëronautical language. The object of this Committee is to sort out the various technical words and see which are the best to use. I think the most satisfactory plan would be for the Committee to thoroughly investigate, say, about 100 of the commoner words, select the best ones, and also ascertain the corresponding words in French, German, and Italian. Work of this kind would be very useful not only to aëronauts, but to the general public, which is at present only too prone to take up all sorts of meaningless words and phrases without considering very much whether they really convey the ideas it is desired to express.

Later on more terms might be taken in hand, but a brief and early report on the words, etc., above alluded to, would, I think, be of great value.

18.—EXHIBITION COMMITTEE

This year a small temporary Committee undertook the work of organising the Society's display at the Travel Exhibition, with very satisfactory results. I think this Committee should be a permanent one, and that all questions, such as the best Exhibition to show at, etc., should be referred to it.

Exhibitions are apparently much favoured by inventors, but I am not myself at all satisfied that it would not be better for the Society to have a private display of its own once a year, as is done by some other Societies. This, however, is a matter which the Exhibition Committee should go into, as there are many points to be considered when settling questions of this kind.

19.—BIRD STRUCTURE COMMITTEE

I think a Committee to examine thoroughly the construction of birds would be a very useful one. Strange to say, although birds are undoubtedly the best flying creatures, comparatively little work has been done in examining their structure from the aëronautical point of view, either in this country or abroad. Very little is known, for instance, of the way in which the wing muscles act, while in such simple matters as the positions of a bird's centre of gravity and centre of pressure, opinions differ in a most extraordinary way. Information of this kind is of the greatest importance, and careful work done by a Committee making a special study of the subject would, I believe, be of the very greatest value.

20.—COMMITTEE FOR THE REVISION OF THE RULES

The present Rules require revision, as they are practically speaking the same as those issued in 1866.

Probably not much alteration is required, but it would, I think, be an advantage to have them revised to suit the present time. The principal thing, to my mind, is to have as few rules as possible, as a long list of complicated regulations seldom leads to satisfactory working.

21.—THE WING COMMITTEE

This Committee sent in its first Report this year, and some very interesting information was obtained from the experiments carried out. The Report attracted a good deal of attention on the Continent, and was published in several foreign periodicals after it appeared in our Journal. A further grant can now be made to Major Moore and his colleagues, and I hope they will be able to continue the very useful and interesting work they have commenced.

22.—CONCLUDING REMARKS

In conclusion my suggestions may be summed up as follows:

1. To continue the original policy of the Society, viz., to adhere to the "objects" as laid down in the Rules.
2. To re-organise the duties of the Hon. Secretary and thus enable the business of the Society to be more efficiently carried out.
3. To develop the system of working by Committees, especially as regards technical subjects.

And if these are adopted I believe the Society will have no difficulty in maintaining in the future the high standard of efficiency set by our predecessors in the past.

The PRESIDENT: Although the subject matter of Colonel Fullerton's paper will be considered at the next Council meeting of the Society, we shall be glad to hear any briefly expressed opinions. (No response.)

The PRESIDENT: Colonel Fullerton's services to the Society, as we all know, have been invaluable. (Applause.) The expenditure of time, work, thought, and energy upon this Society has been lavished in the extreme by Colonel Fullerton. He has asked me to say nothing about it. I generally obey commands, especially from a military man, but in this instance I do think that Colonel Fullerton's retirement is very sad news to me, and I think you will share the feeling with me. (Hear, hear.) I cannot thank Colonel Fullerton sufficiently. (Loud and continued applause.)

Mr. REID: If I may be allowed I should like, as a member of the Council, to endorse the remarks that have been made with regard to Colonel Fullerton's services to this Society. We were languishing a little when he took over the seals of office—if we have any seals, I do not know whether we have—but, at any rate, when he took over the affairs of this Society we were languishing a little. I must say in justice to Colonel Fullerton that he has bestowed the very greatest energy on our affairs, that he has bestowed a degree of courtesy to everybody who worried him, and he has had a great many people worry him during the recent spurt of aëronautical matters, but I know that his unfailing courtesy has left everybody completely satisfied that has ever consulted him in such matters. He is a model of method, if I may be allowed to say so in his presence, and I really don't know whether we shall get anybody who will take his place, who will fill it, at any rate—somebody may take the position, but they won't fill it as Colonel Fullerton has done. And there is only one thing that will compensate, to some extent, for the loss which we are sustaining—Colonel Fullerton is good enough to say that he will continue to assist us and help the Society in any way he can, and I hope we may understand that Colonel Fullerton will do so in the future. I have much pleasure in endorsing, Sir, the remarks which you have made, and I am sure all the Council agree with them. (Loud applause.)

Colonel J. D. FULLERTON: Mr. Frost, Ladies and Gentlemen, I am very much obliged to you for the remarks you have made about my work. I hope to be able to assist the Society in the future and help it to be, as I hope it will be, one of the first and best societies in the world. (Great applause.)

The PRESIDENT: With the promise of assistance in the future from Colonel Fullerton we must rest satisfied, and for that be very thankful. We thank him for his paper, and Colonel Stone for his paper, and those gentlemen who have taken part in the interesting discussion that we have had this evening. With these few words I close the meeting.

Major BADEN-POWELL: Ladies and Gentlemen, before we part may I suggest that we ought to pass a vote of thanks to the Chairman. When he spoke just now about the aërial warfare and how it might bring about universal peace, I do not know whether all of you are aware of the very interesting work which he has written on the subject of universal peace. I am sure, if you have not read it, you ought to read it. I beg to propose a vote of thanks to the Chairman for presiding to-night. (Applause.)

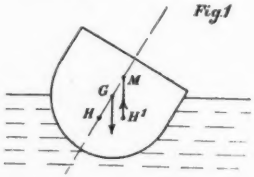
The PRESIDENT: Major Baden-Powell, Ladies and Gentlemen, I am extremely obliged to you for the compliment you have paid me, and especially obliged for the very kind mention of whatever efforts I have made towards universal peace amongst the Powers—all may go a little towards that great object. (Applause.)

CALCULATIONS RELATING TO THE DESIGN OF A FLYING MACHINE *

By A. P. THURSTON, B.Sc.

IN THE design of a vessel the first consideration is to obtain sufficient buoyancy, the second is to obtain stability.

Fig 1



Let G be the centre of gravity of the vessel, H the centre of gravity of displaced fluid when floating normally. If the vessel is given a small displacement let H_1 = centre of gravity of the displaced fluid in the new position. Draw a vertical through H_1 cutting G H in M. Then M is the meta centre.

If M is above G the vertical pressure of the displaced fluid introduces a couple tending to restore the vessel to its original position.

One of the most important problems in Naval architecture is to secure the ascendancy under all circumstances of the meta centre over the centre of gravity.

The couple resisting displacement is $\propto$ to the distance of the M.C. above the C.G.

Hence the stability of the vessel depends on this distance.

Flying machines have points of similar importance. If the points do not fulfil certain conditions then nothing in the world can make a machine fly or prevent it being anything else than a death trap.

* Extract from one of the Patrick Alexander Lectures delivered in 1909, at East London College (University of London).

As we shall use two principles in our calculations it may be well to consider them first.

(1) With regard to moments:

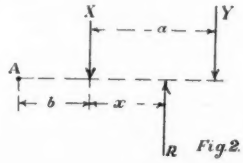


Fig 2.

If we have two or more parallel forces x, y, etc., acting on a body. The resultant = x + y, etc. To find the point at which this force acts we can take moments.

$$\text{Thus } x \times b + y\,(a + b) = R\,(b + x)$$

$$\therefore \quad b + x = \frac{x\,b + y\,(a + b)}{R}$$

$$\therefore \quad x = \frac{x\,b + y\,(a + b)}{R} - b$$

(2) With regard to couples:

A couple introduced anywhere may be balanced by a couple of opposite sign placed anywhere in the same plane.

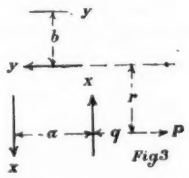


Fig3

Take moments about any point P.

Then we get

$$x\,(a + q) - x\,q + y\,r - y\,(b + r)$$
$$a\,x + q\,x - x\,q + y\,r - y\,b - y\,r$$
$$= a\,x - b\,y = 0$$

An aëroplane has four main forces acting upon it.

(1) The weight acting through the centre of gravity.
(2) Total lift acting through the centre of pressure.
(3) Total resistance acting through the centre of resistance.
(4) Total thrust acting through the centre of thrust.

In the ideal condition, when these four forces act through a common point and are equal, there is equilibrium, thus:

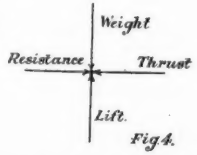


Fig 4.

Now, if the thrust and the resistance are not in line, then the couple introduced may be balanced by introducing a couple of opposite sign formed by arranging the lift and the weight out of line.

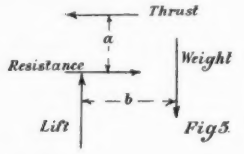


Fig.5.

Thus, thrust above resistance.

(*a*) If thrust x a = lift x b there is equilibrium. If the engine stops in a machine in which the equilibrium is obtained in this way let us consider what happens. The thrust will equal O and the system will be unbalanced, and the lift-weight couple will tend to rotate it, *i.e.*, to cause the front of the machine to rise and turn completely over.

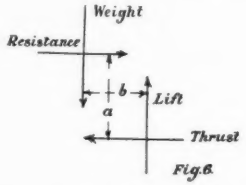


Fig.6.

(*b*) If thrust below resistance then T R couple may be balanced by placing W in front of L. If T is cut out as before the W L couple will tend to rotate the machine by causing the head to dive down.

Thus, although machines in which one of the above state of affairs holds may be made to fly while the engine continues to run, the stoppage of the engine would bring disaster.

The author has seen a good many engines stop in mid-flight, and the result in some cases has shown that sufficient attention has not been paid to this point.

Now, according to the disposition and arrangement of the screws, engine, and various parts of the machine, we can fix the centre of gravity, the centre of resistance, and the centre of thrust, but we cannot fix the centre of lift.

In the case of the inclined plane we have seen that the centre of pressure travels forwards as the angle of inclination is decreased.

In the case of the curved plane the centre of pressure or lift travels forwards with decrease of inclination up to a certain amount, when it travels backwards with a further decrease of inclination.

As a result, we are only able to balance the forces for a particular angle, preferably the angle of inclination most generally taken, and extraneous means must be provided to counteract the couple introduced by the change of the centre of pressure.

The Wrights use a plane in the front, which rides parallel with the wind under normal conditions and gives no lift, but which can be warped in either direction as required.

Thus, the controlling planes are sometimes lifting and sometimes forcing the machine downwards.

By placing controlling planes both fore and aft the fore plane may be used when the centre of pressure travels backwards, and the back plane when the centre of pressure travels forwards.

This is the system which Sir Hiram used in his early machine and it is interesting to note that the most successful and steadiest flyer at Rheims, *i.e.*, the Curtiss machine, had this system of control. There appears to be a considerable future for this system.

To illustrate the method of calculating the position of the four points let us

take an example. As it appears probable that, in the future, more than two propellers will be used, suppose we take four to illustrate the method.

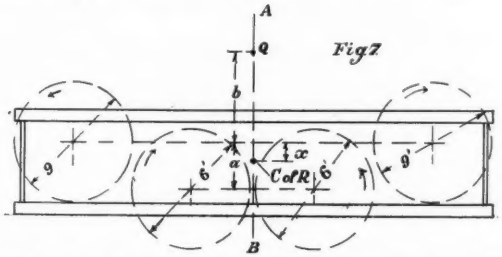


Fig 7

The theoretical speed of all the propellers should be the same, *i.e.*, product revs. × pitch should be equal. If this is so we may assume with a fair degree of accuracy that the thrust of each propeller is ∝ to the area of the screw circle.

$$\text{Total thrust} = K\frac{\Pi}{4}(81 \times 2 + 36 \times 2)$$

To find the centre of thrust. We know it will lie along the line A B, because the propellers are in pairs and are equidistant in pairs from the line A B. ∴ we may take moments about any point Q.

$$\text{Then } K\frac{\Pi}{4}(2 \times 36)(a + b) + K\frac{\Pi}{4}(2 \times 81)\,b$$

$$= K\frac{\Pi}{4}(2 \times 81 + 2 \times 36)(x + b)$$

$$\therefore \quad 36\,a + 36\,b + 81\,b = 117\,x + 117\,b$$

$$\therefore \quad x = \frac{36\,a}{117} \quad \therefore \text{ We know the point at which the thrust will act.}$$

TOTAL LIFT

At an angle of 1 in 10 and at a speed of 40 miles an hour a well-shaped plane will lift 2.25 lbs. per square foot.

Owing to the wind of the propellers the tail will lift double this amount.

$\therefore$ Total lift $= (40 \times 6 \times 2 + 13 \times 3)\ 2.25 + 13 \times 3 \times 4.5 = 1{,}345$ lbs.

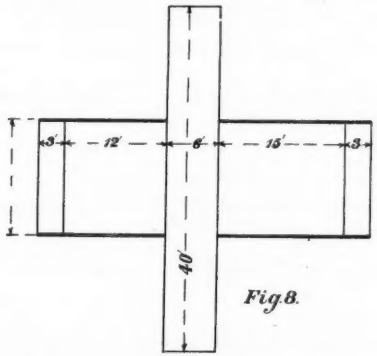


Fig 8.

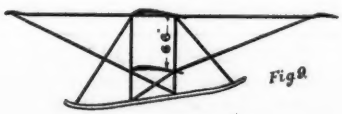


Fig 9

Now, the next point is to calculate total resistance and the centre of resistance. The head resistance of main planes will be about one-ninth the lift, and

$$= \tfrac{1}{9} \times 480 \times 2.25 = \mathbf{120\ lbs.}$$

Resistance of front plane

$$= \tfrac{1}{9} \times 39 \times 2.25 = \mathbf{9.75\ lbs.}$$

Resistance of back

$$= \tfrac{1}{9} \times 39 \times 4.5 = \mathbf{19.5\ lbs.}$$

Resistance of wooden struts

$8 \times \frac{1}{2 \times 12} \times 6.5 \times$ resistance lbs. per sq. ft., and $R = .0013\ V^2$ for elliptical struts having major dia. = 2 minor dia.

$$= .0013 \times 40^2$$

$\therefore$ Resistance of wooden struts

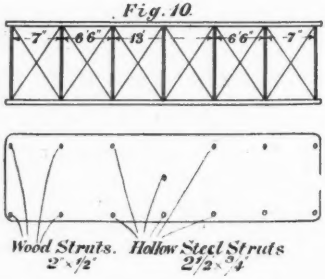
$$\frac{8}{24} \times 6.5 \times .0013 \times 40^2$$

$$= \mathbf{4.5\ lbs.}$$

Resistance of 5 iron struts

$$\frac{5 \times 6.5}{16} \times .0013 \times 40^2 = \mathbf{4.22\ lbs.}$$

Fig. 10.



You will proceed in the same way with all the other parts of the machine and, adding them all together, you will get the *total resistance.*

To obtain the *centre of resistance* we take moments about any point A.

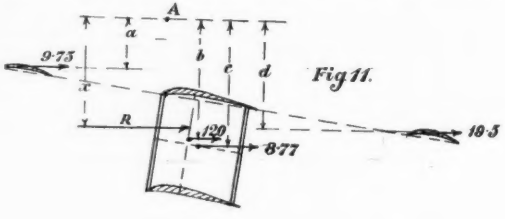


Fig 11.

Then $R \times x = 9.75 \times a + 120 \times b + 8.77 \times c + 19.5 \times d$ and so on,

$$\therefore \quad x = \frac{9.75\,a + 120\,b + 8.77\,c + 19.5d, \text{ \&c.}}{9.75 + 120 + 8.77 + 19.5, \text{ \&c.}}$$

$\therefore$ x being known, the position of the propellers may be fixed so that the centre of thrust and the centre of pressure may be in suitable positions.

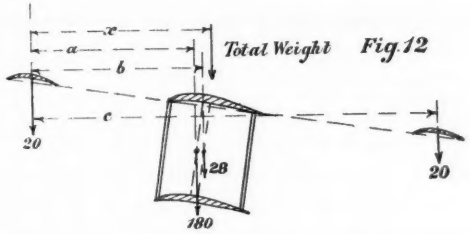


Fig. 12

CENTRE OF GRAVITY AND TOTAL WEIGHT

To obtain the total weight and the centre of gravity we first obtain the weight of the separate parts, by calculation or otherwise.

Thus,

Weight of wooden struts (Spruce 31.25 lbs. per cubic ft.)

$$= 8 \times 6.5 \times \frac{\cdot 829 \times \frac{1}{2} \times 2}{144} \times 31.25 = \mathbf{9.36\ lbs.}$$

Weight of steel struts = **18.3 lbs.**

Total weight of struts = 18.3 + 9.36 = 28 lbs., say.

Weight of main planes (double surfaced):

Total volume of wood = 3,935 cubic inches.

Weight of wood = $\frac{3935}{1728} \times 31.25 = 71$ lbs.

Weight of silk, 3 oz. per square yard = 10.8 lbs.

Total weight = 71 + 10.8 = **81.8 lbs., say 90 lbs.**

In the same way we may calculate the weight of the fore and aft planes and of the other parts of the machine. Then, taking moments about A, we get:

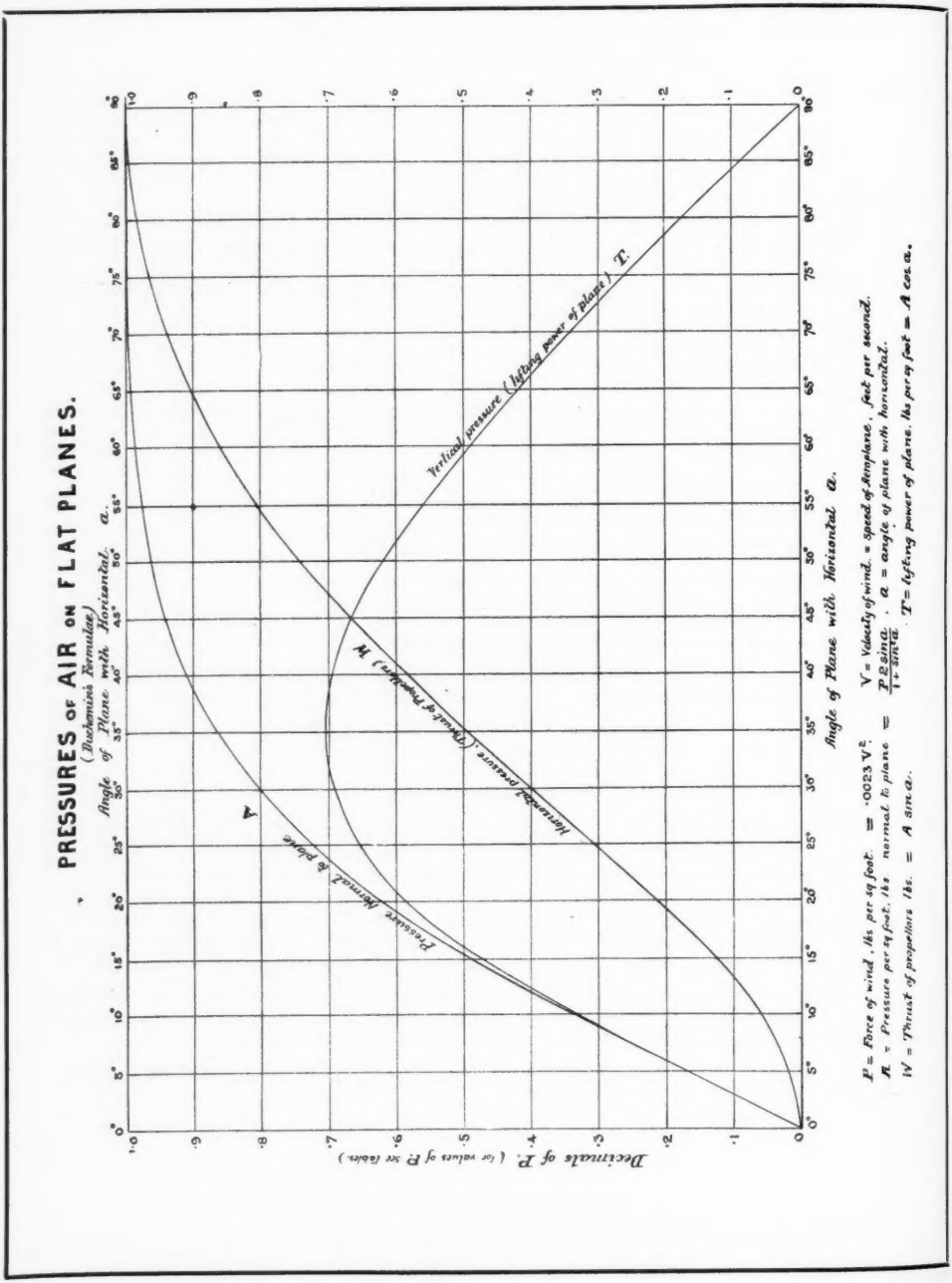
$$\text{Total weight} \times x = 180 \times a + 28 \times b + 20 \times c$$

$$\therefore \quad x = \frac{180\,a + 28\,b + 20\,c, \text{ \&c.}}{180 + 28 + 20, \text{ \&c.}}$$

In our present state of knowledge the determination of the centre of lift is not easy to calculate, because no reliable data is to hand giving the centres of pressure of various surfaces and bodies when inclined at various angles. It is, therefore, best to construct a small model of the machine and determine the centre of lift at any angle by placing it in a wind tunnel; or a small paper glider may be made and the weight adjusted until the best glide is obtained. Then we may assume that the centre of gravity of the figure corresponds with the centre of pressure.

If, when the centre of lift has been determined it is found not to be in the right position relatively to the centre of gravity, then the centre of gravity should be changed by altering the position of the engine or operator, etc.

The above calculations, although simple, are, perhaps, of greater use to the practical man than the higher mathematics of the aëroplane.


PRESSURES OF AIR ON FLAT PLANES.
(Duchemin's Formulæ)
Angle of Plane with Horizontal. a.
Vertical pressure (lifting power of plane) T.
Horizontal pressure (Thrust of Propeller) H
Pressure Normal to plane
A
Decimals of R (for values of R see table.)
Angle of Plane with Horizontal a.
F = Force of wind, lbs per sq foot. = .0023 V².
R = Pressure per sq foot, lbs normal to plane = P 2 sin a / 1 + sin² a.
W = Thrust of propellors lbs. = A sin a.
V = Velocity of wind. = speed of Aeroplane, feet per second.
a = angle of plane with horizontal.
T = lifting power of plane. lbs per sq foot = A cos a.

W = Thrust of propellors lbs. = A sin α. L = lifting power of plane, lbs per sq foot = A cos α.

PRESSURES OF AIR ON FLAT PLANES

By H. B. MOLESWORTH, M.I.C.E.

The two following Tables giving alternative values for P are for use with the Diagram of Pressure Curves.

$P = \cdot0016\ V^2$.

This value of P approximates to Langley's experiments.

V=feet per sec.	Miles per hour.	P.	V=feet per sec.	Miles per hour.	P.	V=feet per sec.	Miles per hour.	P.
1·5	1	·0036	30·8	21	1·518	60·1	41	5·779
2·9	2	·0135	32·3	22	1·669	61·6	42	6·072
4·4	3	·0309	33·7	23	1·818	63·1	43	6·371
5·9	4	·0557	35·2	24	1·982	64·5	44	6·656
7·3	5	·0853	36·7	25	2·155	66·0	45	6·970
8·8	6	·1239	38·1	26	2·323	67·5	46	7·288
10·3	7	·1696	39·6	27	2·509	68·9	47	7·595
11·7	8	·2192	41·1	28	2·702	70·4	48	7·930
13·2	9	·2784	42·5	29	2·890	71·9	49	8·272
14·7	10	·3456	44·0	30	3·098	73·3	50	8·597
16·1	11	·4144	45·5	31	3·312	74·8	51	8·952
17·6	12	·4960	46·9	32	3·520	76·3	52	9·314
19·1	13	·584	48·4	33	3·749	77·7	53	9·659
20·5	14	·672	49·9	34	3·918	79·2	54	10·037
22·0	15	·774	51·3	35	4·211	80·7	55	10·419
23·5	16	·883	52·8	36	4·461	82·1	56	10·784
24·9	17	·992	54·3	37	4·717	83·6	57	11·182
26·4	18	1·115	55·7	38	4·963	85·1	58	11·587
27·8	19	1·237	57·2	39	5·235	86·5	59	11·971
29·3	20	1·373	58·7	40	5·513	88·0	60	12·390

P = pressure on 1 sq. foot of plane, normal to wind, in lbs. = $\cdot0023\ V^2$.

Miles per hour.	Feet per sec. =V.	Feet per min.	P=·0023 V²	Miles per hour.	V=Feet per sec.	Feet per min.	P=·0023 V²	Miles per hour.	Feet per sec. =V.	Feet per min.	P=·0023 V²
1	1·5	88	·005	21	30·8	1848	2·183	41	60·1	3608	8·308
2	2·9	176	·019	22	32·3	1936	2·399	42	61·6	3696	8·728
3	4·4	264	·045	23	33·7	2024	2·613	43	63·1	3784	9·159
4	5·9	352	·080	24	35·2	2112	2·850	44	64·5	3872	9·568
5	7·3	440	·122	25	36·7	2200	3·098	45	66·0	3960	10·019
6	8·8	528	·178	26	38·1	2288	3·340	46	67·5	4048	10·479
7	10·3	616	·244	27	39·6	2376	3·606	47	68·9	4136	10·918
8	11·7	704	·315	28	41·1	2464	3·885	48	70·4	4224	11·399
9	13·2	792	·400	29	42·5	2552	4·154	49	71·9	4312	11·891
10	14·7	880	·497	30	44·0	2640	4·452	50	73·3	4400	12·360
11	16·1	968	·596	31	45·5	2728	4·761	51	74·8	4488	12·87
12	17·6	1056	·713	32	46·9	2816	5·060	52	76·3	4576	13·39
13	19·1	1144	·839	33	48·4	2904	5·389	53	77·7	4664	13·89
14	20·5	1232	·966	34	49·9	2992	5·727	54	79·2	4752	14·43
15	22·0	1320	1·113	35	51·3	3080	6·054	55	80·7	4840	14·98
16	23·5	1408	1·269	36	52·8	3168	6·412	56	82·1	4928	15·50
17	24·9	1496	1·426	37	54·3	3256	6·780	57	83·6	5016	16·07
18	26·4	1584	1·603	38	55·7	3344	7·135	58	85·1	5104	16·67
19	27·8	1672	1·778	39	57·2	3432	7·526	59	86·5	5192	17·21
20	29·3	1760	1·973	40	58·7	3520	7·926	60	88·0	5280	17·81

MEMBERS' WORK

COL. J. D. FULLERTON, R.E. *(Ret.)*

I.—"THE CENTRE OF PRESSURE"

Figs. 1 and 3 show common types of aero surfaces and bodies, inclined at small angles to the direction of their motion—p_1 p_2 . . . . &c., are the air pressures at points a_1 a_2 . . . . &c.

Fig 1

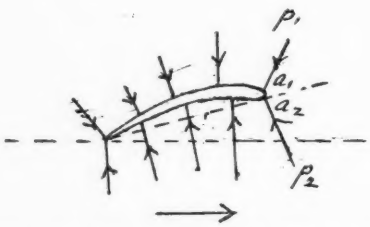
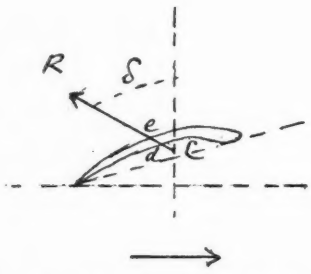


Fig. 2



and resultant of these forces is a force R, see Figs. 2 and 4, acting through a point C, the line of action of which cuts the lower and upper surfaces at d and e respectively.

Fig 3

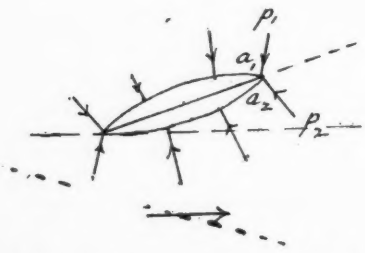
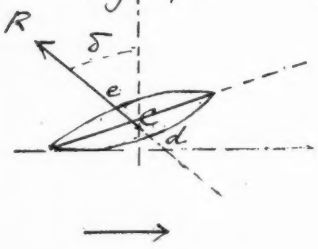


Fig 4



Then the true "centre of pressure" is the point C, because it is at this point that the resultants of forces p_1 . . . . and p_2 intersect.

In aero surfaces the point d, see Fig. 2, is often called the "centre of pressure," but this is a very unsatisfactory definition, as d is merely a point in the line of action of R, like e, and has no special meaning such as applies to C.

Experiment shows that the point C is, for *well-shaped* surfaces and bodies, practically speaking, fixed in position for all angles between + 20° and − 20°. On the other hand, the positions of d and e vary very considerably with every change in the angle of inclination of the surface or body, and they have this very great disadvantage that they cannot be found experimentally in a whirling table. To sum up:—

(1) The "centre of pressure" of an aero surface or body is the point at which the resultants of the forces p_1 . . . . p_2 . . . . intersect.

(2) This point remains, practically speaking, in the same position for all small angles of inclination.

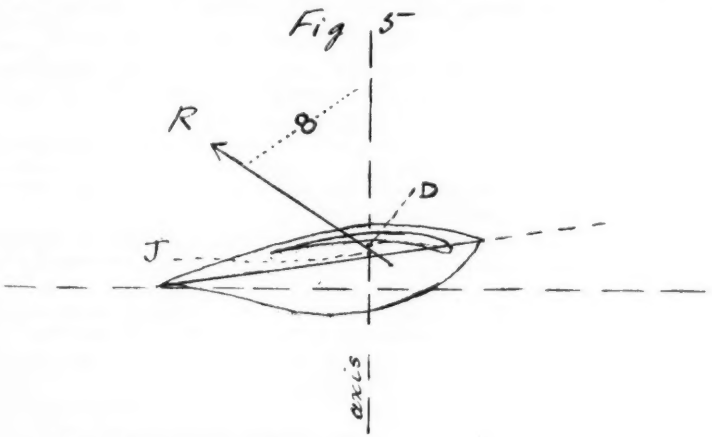
[N.B.—When finding the "centre of pressure" of an aero surface or body in a whirling table, such aero surface or body should be balanced in neutral equilibrium, otherwise the results obtained will be erroneous. See "Aerodynamics," by Professor Langley.]

II.—SOME MODEL EXPERIMENTS

Summary

When designing a machine of any kind it is desirable to ascertain experimentally the values of the air forces, acting on its component parts, viz., the wings or sustainers, the body, and the tail (if any). These experimental results are very useful as the total air forces acting on the model can be obtained from them; and they also show up weak points in the designs of the component parts.

A model of the bird type has been experimented with in this manner, and although the results cannot be given in detail, the following summary may be found of interest.



The work carried out was as follows:—

(1) Tests of the wings, at angles from + 20° to − 20°.

(2) Similar tests for the body.

(3) Computation of the total air forces acting on the model, at angles between + 20° and − 20°. The normal position was wings at − 1° body at + 2°. See Fig 5.

RESULTS

Wing Tests

(1) Magnitude of air pressure: At + 19° the lift was five times the lift at − 1°; at − 21° there was a downward force tending to depress the wing = to twice the lift at − 1°. The drift at + 19° was about 40 times the drift at − 1°, while at − 22°, it was 10 times as great. The ratio of drift to lift at 1° was about $\frac{1}{18}$.

(2) The centre of pressure remained, practically speaking, in the same place, at all angles from + 20° to − 20°.

(3) The position of the line of action of the air force changed very rapidly between + 4° and − 11° the value of δ Fig. 5 changing from 10° to 100° approximately.

Body Tests

The air forces on the body were very small compared with those on the wings, except at the very small angles. At + 17° the lift of the body (dissymmetrical in shape) was only $\frac{1}{30}$ that of the wings at the corresponding angle.

The changes in the lines of action of the air forces were just as rapid as in the case of the wings.

Combined Computations

(1) Magnitude of the air forces; for angles between + 17° and − 13° the increase and decrease in value was very regular in character. At the normal position, the ratio of drift to lift was about $\frac{1}{11}$.

(2) The point J where the line of action of R, see Fig. 5, cut the axis, varied from close up under the wing at + 20° to a point about $\frac{2}{3}$ of the length of the axis from its upper end at − 13°. The changes at the small angles were not very rapid.

(3) The δ angles, see Fig. 5, varied very rapidly between + 5° and − 5°, being 5° 57′ at the former and 143° 52′ at the latter.

The general results of the work done may be summed up as follows:—

(1) The actual design of the wings and body is of very great importance. The better the types employed the less the resistance to forward motion, and the less the power required to drive the machine.

(2) As far as air pressures are concerned, the wings are the most important part of the model, the body as long as it is of a reasonably good shape offering very little resistance in comparison. The particular body experimented with was not a very good one.

(3) The changes of position of the point J, Fig. 5, are not great in a good design, but in an inferior type of machine they may be very considerable.

(4) The rapid changes in the value of the δ angles, see Fig. 5, are of very great importance. They are large, even in good designs, and may, in inferior types of machine, be quite fatal to the longitudinal equilibrium.

(5) Tests of the surfaces, bodies, &c., should always be carried out, as they show at once if any serious error has been made in their design.

(6) The model was purposely made without a tail, in order to see whether it was stable or not. The inclination of the wings was very small—viz. − 1°. The model was tested by dropping it from a height of about 30 ft., and starting it upside down. It turned over into normal position after falling about 5 ft., and, after a further fall of about 15 ft., glided along a very gentle slope to the ground. The balance in still air was very good; the small size of the model, however, prevented it going well in "Disturbed Motion" (see IV. below).

III.—POSITION OF THE CENTRE OF GRAVITY: EFFECT OF THE "DISTURBING FORCES"

Summary

When the motion of a machine in normal flight is varied by some "Disturbing Force," the effect produced by such a Force is to:

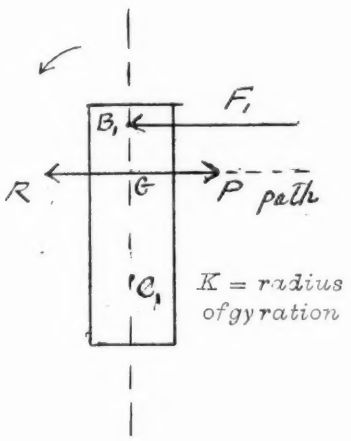
(1) Raise or lower the machine above its normal path.

(2) Cause it to oscillate round some point the position of which depends upon the position of the centre of gravity, the radius of gyration, and the character of the "Disturbing Force" itself.

Disturbing Forces are of two kinds, Impulses, such as sudden gusts of wind, and Finite Forces, such as those set up by shifting a portion of the machine's load, &c. The Impulsive Forces are the most dangerous ones, as their action is so rapid that

the steersman has little time to counteract their influence, and it is consequently absolutely necessary to so design a machine that the *worst possible Impulsive Forces* likely to act upon it will not endanger its safety. The general effect of Disturbing Forces in cases of this kind is as follows:—

Fig 6



CASE 1.—Let a body of any kind originally moving along the path shown in Fig. 6, in "Steady Motion," be disturbed by an Impulsive Force F, acting as shown. G = centre of gravity of the body. P = the thrust or driving force. R = resistance. $C_1 G = a_1$, $C_1 B_1 = h_1$, K = radius of gyration. The body as soon as F acts will commence to rotate round some point, say C_1.

$$\text{Angular velocity} = \omega = \frac{F_1 a_1}{M (K^2 + h_1^2)} \qquad (1)$$

$$h_1 = \frac{K^2}{a_1 - h_1} \qquad (2)$$

From (1) it is clear that the angular velocity decreases as K and h_1 increase, while (2) shows that h_1 increases as $a_1 - h_1$ diminishes. Hence in order to make the angular velocity as small as possible G should be *as high up* as possible, for then h_1 has its maximum value.

CASE 2.—In this case F_2 acts at B_2 (see Fig. 7), the body begins to rotate round some point C_2, and equations similar to those used in Case 1 show that the centre of gravity should in this case be placed *as low as* possible.

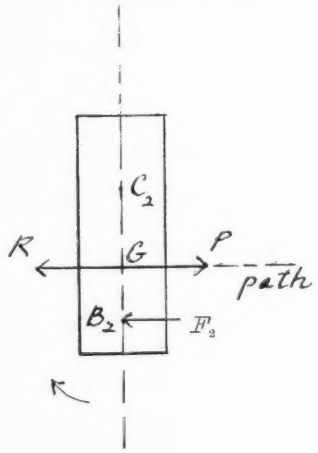
GENERAL RESULT.—Now as G cannot be both *high up* and *low down*, there must be some mean position which will be the most favourable one, when the circumstances of the two cases are taken into consideration. Such position is given by

$$F_1 \times GB_1 = F_2 \times GB_2 \qquad (3)$$

(since F_1, F_2 and B_1, B_2 are known by supposition), for when G is thus fixed, the turning moments are equal, and the body is not more liable to turn over backwards than forwards.

Flying Machine.—The application of the above principles is of course obvious;

Fig 7



F_1, F_2 may be taken as the horizontal components of the most unfavourable Impulsive Forces, and since the dimensions of the machine itself are also known the position of G can be calculated from an equation similar to (3) above. The experiments with the model referred to in II. above are not yet concluded, but so far, they show that assuming + 20 and − 15° to give the worst turning moments of F_1 and F_2 then the best position for G is quite close up to J, Fig. 5, which is what would be expected in models of this type.

IV.—ON THE LONGITUDINAL EQUILIBRIUM OF A FLYING MACHINE

Summary

This summary explains the general nature of the problem, gives briefly the mathematical formulæ required for its solution, and shows how the results obtained influence the design of a machine.

General Principles.

A common type of machine is shown in Figs. 8 and 9. It is assumed that the "Disturbed Motion" is caused by a force F, which represents the disturbing effect due to the shifting of a small part of the load of the machine. The general steps of the investigation are:—

(1) Formation of equation of "Steady Motion."
(2) Formation of equations of "Disturbed Motion."
(3) Combination of (1) and (2) above to form the "General Equation of Stability."
(4) Finding the conditions which this latter must fulfil in order that the machine may be stable.

These latter conditions are of very great importance, as once the experimental data are available, the question of stability can be settled *without actually solving the equation.*

Fig. 8.

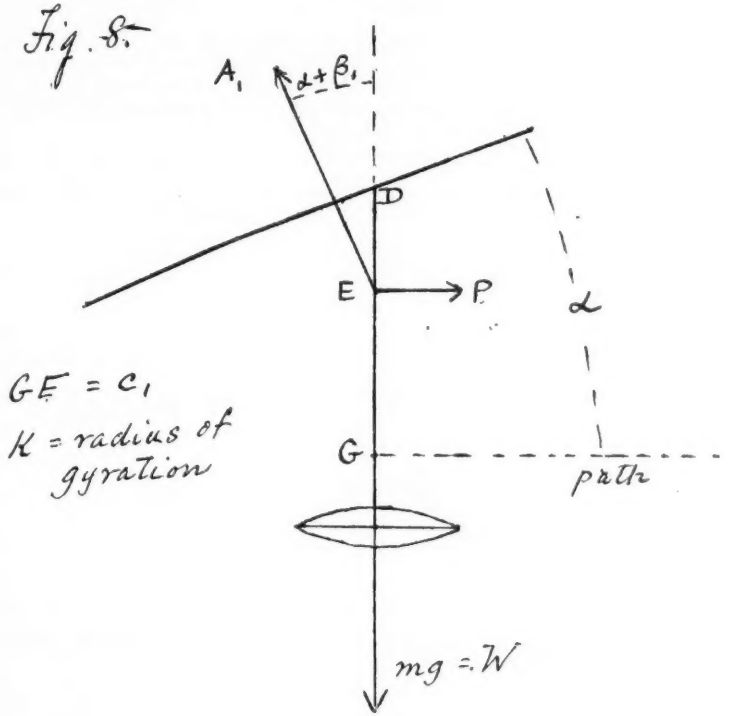
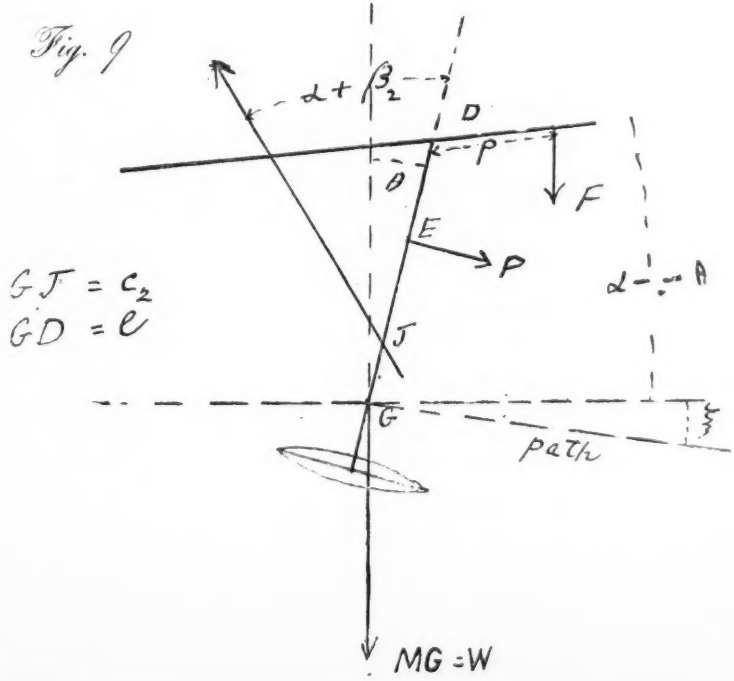

A1
α + β1
D
E
P
α
GE = c1
K = radius of gyration
G
path
mg = W

Fig. 9


α + β2
D
P
θ
F
E
P
α
GJ = c2
GD = e
J
G
ξ
path
MG = W

It will be noticed that the extent of the stability is first ascertained on the assumption that the machine is tailless. The reason for this is that a well-designed machine should be very nearly stable without a tail, and consequently it is desirable to ascertain how far the equilibrum is defective before designing a tail to remedy faults of balance.

MATHEMATICAL FORMULÆ.

(1) Let Fig. 8 represent a machine in "Steady Motion" moving with a constant velocity V, then the equations of "Steady Motion" are

$$M\frac{d^2x}{dt^2} = P - A_1 \sin(\alpha + \beta_1) = 0 \qquad [1]$$

$$M\frac{d^2y}{dt^2} = mg - A_1 \cos(\alpha + \beta_1) = 0 \qquad [2]$$

$$Mk^2\frac{d^2\theta}{dt^2} = Pc_1 - A_1 \sin(\alpha + \beta_1)\, c_1 = 0 \qquad [3]$$

(2) For the "Disturbed Motion" the equations are (see Fig, 9):

$$M\frac{d^2x}{dt^2} = A_1 \sin(\alpha + \beta_1) - A_2 \sin(\alpha + \beta_2 - \theta) \qquad [4]$$

$$M\frac{d^2y}{dt^2} = P\sin\theta + A_1 \cos(\alpha + \beta_1) - A_2 \cos(\alpha + \beta_2 - \theta) + F \qquad [5]$$

$$Mk^2\frac{d^2\theta}{dt^2} = A_1 c_1 \sin(\alpha + \beta_1) - A_2 \sin(\alpha + \beta_2 - \theta)\, c_2 + F(p\cos(\alpha - \theta) + l\sin\theta) \qquad [6]$$

(3) Let $\beta_1 = f(\alpha) \quad \beta_2 = f(\alpha - \theta + \xi)$, then $\beta_2 = \beta_1 + \lambda(\theta - \xi)$ where $\lambda = -f^1(\alpha)$.

(4) From equation [4] assuming V to be constant for a short period; and substituting the value of λ

$$A_2 = A_1\{1 - \cot(\alpha + \beta_1)(\lambda\theta - \theta - \lambda\xi)\} \qquad [7]$$

(5) From equation [5] it can be shown that

$$\frac{d^2y}{dt^2} + \frac{A_1\lambda}{MV\sin(\alpha + \beta_1)}\cdot\frac{dy}{dt} + \frac{A_1\cos^2(\alpha + \beta_1) - \lambda)}{M\sin\gamma}\,\theta = \frac{F}{M}.$$

which may be written

$$\frac{d^2y}{dt^2} + R\frac{dy}{dt} + S\theta - \frac{F}{M} = 0 \qquad [8]$$

(6) Let $c_1 = \phi(\alpha) \qquad c_2 = \phi(\alpha - \theta + \xi)$

$$c_2 = c_1 + \kappa(\theta - \xi) \text{ where } \kappa = -\phi^1(\alpha)$$

(7) From equation [6] and substituting

$$\frac{d^2\theta}{dt^2} - \frac{A_1\kappa\sin(\alpha + \beta_1)}{m\,k^2V}\cdot\frac{dy}{dt} + \frac{A_1\,\kappa\sin(\alpha + \beta_1) - F(l + p\sin\lambda)}{m\,\kappa^2}\,\theta - \frac{F\,p\cos\alpha}{m\,k^2} = 0$$

which may be written

$$\frac{d^2\theta}{dt^2} - T\frac{dy}{dt} + U\theta - \frac{F\,p\cos\alpha}{m\,k^2} = 0 \qquad [9]$$

(8) Combining [8] and [9], etc.

$$\frac{d^3\theta}{dt^3} + R\frac{d^2\theta}{dt^2} + U\frac{d\theta}{dt} + (ST + RU)\,\theta - \frac{Tk^2 + R\,p\cos\alpha}{m\,k^2} = 0 \qquad [10]$$

(9) The equation of stability may then be written

$$\mu^3 + R\mu^2 + U\mu + (ST + RU) = 0 \qquad [11]$$

(10) The conditions of stability are:

$$\begin{matrix} R & RU - (ST + RU) & (ST + RU) \\ & \text{or} & \\ R & -ST & (ST + RU) \end{matrix}$$

must all be positive

(11) *1st Condition.*

$$R = \frac{\lambda A_1}{m V \sin(\alpha + \beta_1)}$$ which is positive when λ is positive.

Now $\lambda = -f^1(\alpha)$ therefore for λ to be $+$, $f^1(\alpha)$ must be negative. Hence $\beta_1 = f(\alpha)$ must decrease as α increases.

(12) *2nd Condition.*

$$-ST = \frac{A_1}{m^2 k^2 V} \times \kappa (\lambda - \cos^2(\alpha + \beta_1))$$

which is positive if $k(\lambda - \cos^2(\alpha + \beta_1))$ is positive, viz.: k and $(\lambda - \cos^2(\alpha + \beta_1))$ are of the same sign. But λ will always be small in comparison to $\cos^2(\alpha + \beta_1)$ hence k must be negative for stability (see remarks on λ above).

(13) *3rd Condition.*

$$ST + RU = \frac{A_1}{m^2 k^2 V \sin)(\alpha + \beta_1)} \left\{ A_1 k \cos^2(\alpha + \beta_1) \sin(\alpha + \beta_1) - F\lambda (1 + p \sin\alpha) \right\}$$

which is positive when

$$F \text{ is less than } \frac{A_1 k \cos^2(\alpha + \beta_1) \sin(\alpha + \beta_1)}{\lambda (1 + p \sin\alpha)}$$

This latter condition is of great importance as it gives the maximum value of F when the data for the case are given.

With regard to the question of stability at low velocities, A_1 varies as V^2 hence

$$F \text{ varies as } V^2 \times \frac{\kappa}{\lambda} \frac{\sin(\alpha + \beta_1)}{(1 + p \sin\alpha)}$$

but in a well designed machine $\frac{\kappa}{\lambda}$ is large, and consequently a machine can be much more stable at moderate velocities than is generally supposed.

GENERAL RESULTS

From the above it will be seen that the following points should be attended to when designing a machine.

1st.—The design itself should be very carefully drawn out—special attention being given to the type of sustaining surface, as a great deal of the efficiency of the machine depends upon it.

2nd.—The wings, body, and tail should be tested separately as explained in II. above, so as to find the most favourable angles at which each should be placed.

3rd.—The higher the velocity, the better the stability, but good design will enable a machine to be stable at quite moderate velocities.

4th.—The inclination of the wings, when the machine is in normal flight, is a matter of great importance. It should be as small as possible compatible with stability, as the power required to drive the machine is then much reduced.

5th.—When the inclination of the wings is small it will not be possible to move about any large proportion of the load, during flight, but good design will materially assist as regards this point.

EFFECT OF A TAIL

It is not intended to discuss this matter in this note, but it may be pointed out that the function of the tail is to act as a balancer and prevent the machine deviating from its normal position as far as possible, and it is clear that the better the design, the smaller will be the tail required.

NOTES

The Death of Senor Fernandez.—Antonio Fernandez, whose death it is our painful duty to record, was born near Madrid on February 2nd, 1876. He was a master tailor with establishments at Paris and Nice, and made his first public appearance in aviation at the Rheims meeting in August last year with a biplane of his own design. Ill-luck, however, pursued him throughout his trials. At Rheims his machine never left the ground, at Blackpool he only made one "long hop" of about 1,200 yards, and finally at Nice, just when he was beginning to make successful flights, death overtook him.

It seems that, impatient of delay, he made a hasty repair to a broken working part of his front governor, and that the re-breaking of this during flight caused the fatal accident. On the morning of December 6th last he was flying about 20 metres from the ground when the machine suddenly dived and fell to the ground head-foremost. The unfortunate pilot was killed outright.

In him Spain offers her first martyr to the cause of aviation.

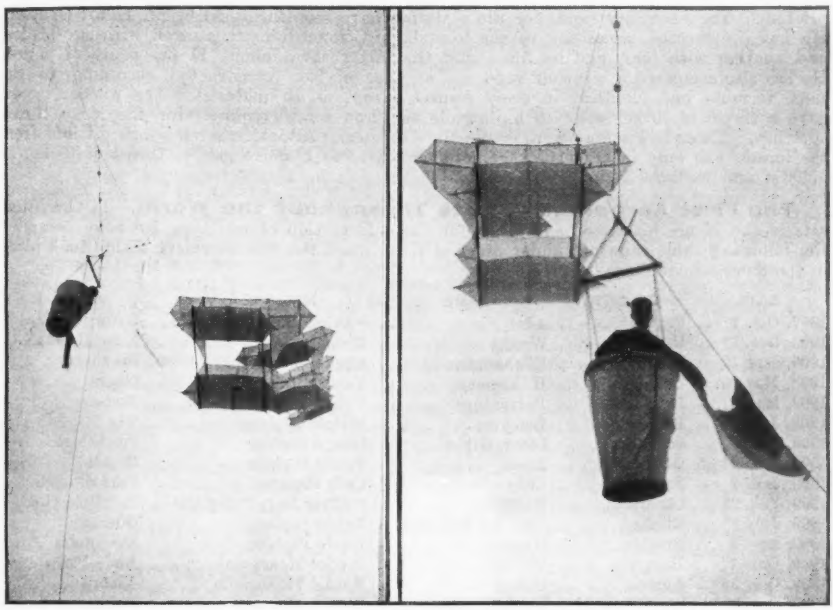
Leon Delagrange.—There are few names that stand higher in the glorious history of aviation than that of Léon Delagrange, whose services were invaluable by reason of the early and thankless period at which they were rendered and of the devoted enthusiasm wherewith they were subsequently continued. Born at Orléans in 1873, the son of a well-known cotton-manufacturer of that town, Léon Delagrange at a compara-

Leon Delagrange

tively early age, entered the Ecole des Beaux Arts in Paris, where—curiously enough—Henry Farman and Gabriel Voisin were numbered among his fellow-students. His subsequent career as a sculptor gave rare promise—more than once his work figured in the Salon—and was only interrupted by his suddenly acquired enthusiasm for aviation. His first aëroplane was ordered from MM. Voisin in 1906, before ever M. Santos Dumont had popularised what soon became "the new sport." After the inevitable series of mishaps this biplane, piloted by Charles Voisin, at Bagatelle, rose from the ground for the first time on March 7th. It was not, however, until a year later that Delagrange made his first flight: at Issy on March 14th. But thereafter he progressed with extraordinary rapidity: on April 11th he established a record at Issy by flying 3,925 m. in 6½ min. round a circular course, thus gaining the Archdeacon Challenge Cup from Farman. Delagrange was the first to make a flight of ¼-hour's duration: a feat accomplished at Rome, before the King of Italy, on May 30th, 1908. During the summer of last year he definitely abandoned the biplane in favour of a Blériot monoplane, with which he once again rapidly brought himself into the front rank of pilots. His remarkably fine flights at Doncaster will be vividly remembered, no less than the seeming genial *insouciance*

wherewith they were accomplished. On December 30th, Delagrange once again established a world's record: his flight of 2 h. 30 min., during which he covered some 125 miles on a Blériot monoplane, has never before been approached. It is as difficult to voice the deep and universal regret at the premature close of so brilliant and promising a career, as to express at all adequately in a few words the immense value of the services that he gave to aviation with a free hand. His generosity, true modesty, and courage combined to form an eminently lovable nature. We lay our silent tribute before the image of greatness.

The Sem-Jacobsen System of Man-Lifting Kites.—This system, of which two illustrations are given, consists of seven kites of a modified Hargrave type with either a linen gondola or a basket suspended beneath. The team comprises one kite of 5.3 m^2, four of 13 m^2 and two of 21 m^2 surface, all being built of bamboo covered with Egyptian cotton cloth or silk. Magnalium tubing can be substituted for bamboo, if de-



The Sem-Jacobsen System of Man-Lifting Kites

sirable. The cable is of extra flexible steel wire, 8 mm. in thickness, and the windlass used is of the ordinary type with exchange and hand-brake.

The team can be used in a wind-velocity of anything between 7 and 15 metres per second, though 8 m.p.s. is sufficient to raise one man with six kites only, or two men with seven kites. Ascents have been made to 800 metres.

The whole apparatus, which may be stowed away on an ordinary waggon, can be fitted up ready for an ascent in half-an-hour by eight men.

Systems have been bought by the Danish Government, and will be used in the Amundsen Arctic Expedition this year. The price, we understand, is £166 complete.

Propeller Tests in France.—The following interesting account of recent propeller tests appeared in *The Times Engineering Supplement*, November 24th, 1909:

The experimental laboratory of the Conservatoire des Arts et Métiers has for some time been engaged on a large number of experiments with aërial screws. This establishment in 1904 began to provide itself with equipment in view of work of this kind, and owing to the rapid increase in the experiments it has had to improve its organisation and to perfect its methods.

The machine at present in use is an electrical dynamometer provided with speed gears and suspended by four steel wires in such a way that it will oscillate like a pendulum. It enables three simultaneous measurements to be made—the thrust exercised by a screw at a given speed, the power expended on the screw to produce the thrust, and the angular velocity of the screw. The thrust is measured by weights placed on the balance to bring back the pendulum to its initial position of equilibrium, and the corresponding power consumption is measured by an electrical apparatus. The angular velocity is measured by means of an electro-magnetic counter.

A series of measurements is made for regularly increasing thrusts, and for each propeller a thrust-curve is established in terms of the power expended and a velocity curve in terms of the thrust. The laboratory possesses three electrical dynamometers of 30, 50, and 120 h.p. The speeds between which these machines can work while developing their full normal power range between 500 and 1,500 r.p.m.

M. Boyer-Guillon, who is in charge of the experiments, has carried out some interesting investigations on screws of different types, in addition to those sent in by their proprietors. The necessary funds for those studies have been furnished by M. Henri Deutsch. He has constructed, according to the formulæ of Colonel Renard, a screw with two blades, and another with four, and he finds that the latter saves about 11 per cent. of power. He has also compared a screw of wood and another of iron constructed according to the same formulæ and identical in every respect except as to material. The wooden screw gave a thrust of 50 kg. with 7.6 h.p., while the iron screw required for the same thrust 10.4 h.p. These two screws were 60 cm. in diameter. A wooden screw which differed from the former one only in having its diameter increased to 1 metre gave a thrust of 15 kg. at 1,400 r.p.m. with 2.7 h.p.

The First Aeroplane Flights Throughout the World.—In the interests of the future historian, as well as for the information of members, we have compiled the following table showing, under order of date, when the first aëroplane flights took place in the different countries.

DATE	COUNTRY	NAME	MACHINE	PLACE
1897, Oct. 17	France	Ader	"Avion" Monoplane	Satory
1903, Dec. 19	U.S.A.	Wright	Wright Biplane	Kitty Hawk, N.C.
1906, Sept. 12	Denmark	Ellehammer	Ellehammer	Sindholm
1908, May 26	Belgium	H Farman	Voisin Biplane	Ghent
1908, May 27	Italy	Delagrange	Voisin Biplane	Rome
1908, July 18	Holland	Lefébvre	Wright Biplane	The Hague
1908, Oct.	Scotland	Lieut. Gibbs	Dunne Biplane	Perthshire
1908, Nov. 24	Germany	Zipfel	Voisin Biplane	Berlin
1909, Jan. 2	England	Cody	Cody Biplane	Farnborough
1909, Feb. 23	Canada	McCurdy	"Silver Dart" Biplane	Baddeck, N.S.
1909, July 25	Russia	Van der Schrouff	Voisin Biplane	Odessa
1909, Aug. 3	Sweden	Hansen	Voisin Biplane	Stockholm
1909, Oct. 17	Hungary	Blériot	Blériot Monoplane	Buda-Pesth
1909, Oct. 23	Austria	Blériot	Blériot Monoplane	Vienna
1909, Oct. 30	Roumania	Blériot	Blériot Monoplane	Bucharest
1909, Nov. 15	Algeria	Métrot	Voisin Biplane	Algiers
1909, Dec. 2	Turkey	Baron de Caters	Voisin Biplane	Constantinople
1909, Dec. 9	Australia	Defries	Wright Biplane	Sydney, N.S.W.
1909, Dec. 15	Egypt	Baron de Caters	Voisin Biplane	Abbassia
1909, Dec. 28	South Africa	Kimmerling	Voisin Biplane	East London
1909, Dec. 31	Ireland	Ferguson	Ferguson Monoplane	Hillsborough

REVIEWS

The Conquest of the Air.—By A. Lawrence Rotch, S.B., A.M. Present Day Primers Series (Moffat, Yard and Company: New York; pp. 192, illus.; 1909).

The value of a book of this kind does not lie in the discussion of up-to-date records, but in the simple and concise treatment of an exceedingly complex subject, in such a manner that the reader may obtain readily that general knowledge of the subject which will enable him (or her) to follow with intelligent interest the progress of a science which appeals to us from so many different points of view. It will at the same time give the serious student sufficient insight into the subject, as a whole, to enable him to direct his

studies profitably when proceeding to the more thorough investigation of the scientific and technical problems, which offer an almost limitless field of research to the specialist.

The first chapter deals with "The Ocean of Air" in a remarkably clear and interesting manner. This is a branch of study of the highest importance to aëronauts, and requires to be thoroughly understood by those who contemplate the employment of dirigibles and aëroplanes for practical purposes. The author shows by means of carefully compiled (but far from exhaustive) statistics: (1) That the velocity of air currents increases with the height above the earth; and (2) That an endless variety in direction is found at different altitudes; and deduces from these ascertained data that "Dirigible balloons, like low-powered steam vessels, may also profit by the prevailing winds, and, therefore, to ascertain the meteorological conditions which balloons and aëroplanes must encounter at different heights, places, and times, such knowledge as is outlined in this chapter will be eagerly sought."

The comments on the inadequacy of the ordinary anemometer to register the full force of the wind, owing to the fact that it measures only the *horizontal* component of the force, are most interesting, especially to those who were struck by the obviously low readings of these instruments at Rheims and at Blackpool, compared with the observed force of the wind by experienced judges. The correct measurement of the *total* force of the wind is essential to enable us to obtain reliable evidence of stability under given conditions.

In Chapter II. we have a most interesting "history of aërostation," which includes some delightful letters from Benjamin Franklin, U.S. Minister to the Court of France, describing the first experiments with a hot-air balloon.

The author explains the method of carrying out meteorological observations by *ballons-sondes*, introduced by the French in 1893, and subsequently improved upon by Dr. Assmann's clever invention for bringing the recording instruments safely to ground in parachutes, which act automatically on the bursting of the balloon at its maximum altitude.

Chapter III. is a concise history of the evolution of the dirigible balloon, and well deserved credit is given to Santos Dumont, whose "great service consisted in popularising the motor balloon and in inducing the French Government to take up the aeronat (*i.e.*, the dirigible balloon) again." It is interesting to note that the *ballonnet*, which forms an indispensable part of every non-rigid dirigible at the present day, was first proposed more than a century ago by General Meusnier; its action is briefly and clearly explained.

The special characteristics of all the modern dirigibles (up to the end of 1908) are discussed. The author has carried on the confusing nomenclature of the Zeppelin dirigibles without explaining that "Zeppelin II." was the *fourth* airship constructed on the Zeppelin principle. He terms this ship "Model No. IV." in the letterpress and "Zeppelin IV." in the title of the plate. It is now officially known as "Zeppelin II." "Zeppelin III." was only launched in 1909 and differs in certain important respects from the re-constructed "Zeppelin II.," which the author has erroneously termed "Zeppelin III."

We should have been glad if the author could have found space for a discussion on the position of propellers with reference to the centre of pressure. The practice varies in different types, and the subject is full of interest, though possibly too technical for a primer of the modest dimensions of Mr. Rotch's book.

The comparison between the rigid, semi-rigid, and non-rigid types is somewhat cursory. For instance, the conspicuous advantage which the rigid system offers by reason of its being built in compartments is not even mentioned. This advantage was forcibly demonstrated on August 30th, 1909, when "Zeppelin III." had one of her compartments perforated and torn by a broken propeller blade, but was able to reach her destination notwithstanding. Compare this with the total collapse of the "République" on September 25th from a similar accident.

Towards the end of this chapter (bottom of p. 122) the author springs upon us the axiom that "the motive power increases as the *cube* of the speed for balloons of similar design and the weight per horse-power diminishes in the same ratio." We should have liked to see how this was arrived at, especially in view of the fact that in the example given the speed is doubled when the h.p. is squared; the latter part of the example would have been easier to follow if the ascensional force of the balloon were given as one of the data.

The beginning of the chapter on "The Flying Machine" is also unsatisfactory from the crude manner in which the laws governing stability and the resistance of the air are dealt with, while at the same time the reader must have a considerable previously acquired knowledge of the subject to enable him to follow the author intelligently. One quotation will suffice: "As regards progression through the air, since the power must be increased as the cube (*sic*) of the speed, the flying machine has an enormous advantage over the

dirigible balloon in requiring much less power to advance through the air on account of its smaller bulk."

The author is, in fact, not at his best in this portion of the work, which bears the impress of compilation and condensation from the scarcely digested writings of others. The elementary laws of resistance are not even stated, and the basic principle upon which the aëroplane depends, of resolving the resistance of the air acting normally to a plane into its vertical and horizontal components of *Lift* and *Drift* is not discussed. There is no allusion to the interesting and all-important problem of the position of the centre of pressure, and the principle of the curvature of the sustaining surfaces is briefly dismissed in the following words: "These surfaces, usually concave below to increase the lift," etc. The principle of the *aspect ratio* is also dismissed in the following words: "Aëroplanes have sustaining surfaces slightly inclined to the horizon and *largely outspread in a transverse direction*. It needs no further argument to show how disappointing this section of the book is.

The dissertation on the lines of investigation along which experiments have been carried out with aëroplanes is of great interest, and their division into two categories, viz. (1) gliding experiments, and (2) experiments with motive power, is distinctly sound. But here again the interest is due more to the concise presentation of ascertained facts in their proper chronological sequence than to the enlightenment afforded to the student in regard to the solution of the complex problems of stability, ascension, and progression.

In discussing "The Future of Aërial Navigation" the author shows clear insight into the problem of the employment of military dirigibles. In discussing their offensive uses he writes: "By flying high in the air during the day time, and descending at night, airships might launch explosives and produce great damage." Neither the author nor anyone else has yet been able to devise a satisfactory means of defence against night attack by airships, but we may tender our thanks to the author for adding his voice to those which have already been raised to point out wherein lies the real danger of aërial attack.

It is with regret that we have to draw attention to the slovenly writing of the following sentence: "In the balloon the carrying capacity is proportional to the volume, which increases as the cube of the surface and weight." It may be suggested that *lifting* capacity is meant instead of *carrying* capacity, but the meaning of the sentence must still remain an enigma.

The author is in agreement with most advanced thinkers in believing that "while the dirigible may have its uses, the aëroplane will generally supplant it," and also in concluding that "neither class of aërial craft will ever compete with railroads or ships as commercial carriers," and that "on the whole we can agree with Mr. Chanute that while dirigible balloons and flying machines constitute a great mechanical triumph for man, they are not likely to upset materially existing conditions of life as is frequently predicted." We venture, however, to exclude military operations from this pronouncement, believing, on the other hand, that they will be profoundly affected.

We offer our unstinted congratulations to the author on the historical, statistical, and meteorological portions of his book, and on the sound conclusions at which he has arrived on the innumerable points touched upon, and we hope that in the next edition he will be able to find space for a chapter on "Stability and the Resistance of the Air," explaining simply by the aid of diagrams and algebraic symbols, followed by concrete examples, those important laws which govern the construction of dirigibles and aëroplanes; without this no book on "The Conquest of the Air" can be quite complete or altogether intelligible.

F. G. S.

Contributions to the Investigation of the Upper Air. Comprising a Report by W. H. Dines, B.A., F.R.S., with an introduction and a note by W. N. Shaw, Sc.D., F.R.S. Published by the Authority of the Meteorological Committee (H.M. Stationery Office: London; 1909; pp. 56; Figs.; 2s. 6d. net).

Although (needless to say) not issued for the especial service of aëronautics the Blue Book on the Free Atmosphere in the British Isles in which the Meteorological Committee report on investigations of the upper air could not have appeared at a more opportune moment from our point of view. The publication contains a general survey by Sir W. N. Shaw of contributions that have been made to these investigations, a report by Mr. Dines on apparatus and methods in use at Pyrton Hill, and a note by Dr. W. N. Shaw on perturbations of the stratosphere. Here, at any rate, is a part of that complete investigation of the atmosphere which has already become a necessity to aëronautical science. Many people will probably be surprised that so much has been done as is described in the report, but an examination of it whets the appetite for more. Any doubt as to the value of the exhaustive study of the atmosphere in all localities, and as high as it can be fathomed, is easily set aside by these researches, for although they throw light on many vexed questions, they raise far more problems than they solve.

During the past two years the investigation of the upper air in this country has been a co-operative enterprise in which a number of scientific men have engaged. But without going into the history of the matter, let us glance at some of the results. By the way, where the word "stratosphere" is used what is more generally known by the inexact term "isothermal layer" is meant.

"One curious point in the history of the observations of the upper air," writes Mr. Dines, "deserves notice. It will be remembered that in the historic ascent of Mr. Glaisher in 1862 he found that the rate of diminution of temperature fell off and the air tended towards an isothermal condition. That was the generalisation that was accepted until the modern work in the upper air, and the most recent researches tend again towards the adoption of a limit to the fall of temperature at an accessible height. The highest of Glaisher's ascents extended to about 9 kilometres. When it was repeated by Berson in 1894 no indication was found of any such tendency to a limiting value. The differences between the two results are attributed to errors due to the insolation of Glaisher's thermometers. We now know that the stratosphere can be found sometimes at not more than 8 kilometres from the ground. The height varies considerably from day to day and from place to place."

After some very interesting remarks on the accuracy of the results obtainable by the apparatus employed, Mr. Dines gives a preliminary survey, taking care to point out, however, that until the results of all the Continental observations are published it is unwise to draw any definite conclusions. However, he says:

"I am inclined to think from current observations at Pyrton Hill that very large departures from the normal in regard to temperature are more emphasised at 1,000 metres than at the surface; that is to say, that if, in winter, the day is unusually cold, a steep vertical temperature gradient will be found, and if, in summer, the weather is unusually hot, a small gradient or an inversion will be found in the lower strata. Anticyclonic conditions are usually accompanied by an inversion, and the dreary type of anticyclonic cloud that is so common in England from November to April nearly always lies just under an inversion. There are many other points that might be investigated and for which the many published records of kite ascents afford data; the character of the wind, for example, whether gusty or steady, whether it increases or decreases above 500 metres or backs or veers to an unusual extent."——"It is evident that when low temperatures are met with it is in consequence of the continuance of the gradient above its usual height rather than on account of its greater steepness. In the tropics the isothermal column is not reached at so low a level as it is in Europe."——

"Especially low temperatures were met with during the last week of July and at the beginning of October, 1908. These dates show instances of particularly fine, settled weather. Excepting on September 12th the balloon ascents from June to December, 1907, show high temperatures above, and the weather was generally wet and unsettled during this whole period with the exception of the last three weeks of September. It seems reasonable to think there may be some connection."

It is suggested by Mr. Cave that the wind velocity decreases rapidly as the balloon enters the isothermal layer. It is generally found that balloons which reach the greatest heights do not fall at such a distance from the starting point as the greater time occupied would lead one to expect; as to which Dr. W. N. Shaw comments: "Such evidence as we have goes to show that the stratosphere is a region of comparative calm. There seems to be no discontinuity in its direction, but, if anything, a falling off of the velocity of the wind when the boundary is passed. It is above the highest visible clouds and the amount of moisture is so small as practically not to count in the thermodynamic properties of the air."

In the description of the apparatus and methods used by Mr. Dines the aëronautical bodies have the basis for the extended work all over the country which it may well be within their province to assist.

C. C. T.

The British Correspondence School of Electrical Engineering.
Course of Instruction in Aëronautics; 1909-1910; Lessons 1-7 (inclusive).

The first three lessons deal with balloons and dirigibles, which, being used at present chiefly for military purposes, are not, perhaps, of so much importance to the engineer as the heavier-than-air machine.

The first ascent in Great Britain is stated to have been made in August, 1874, evidently a misprint for 1784. Balloons are described as being mostly "pear-shaped" instead of spherical. "Soaring balloon" is not a happy expression, and "cage" is scarcely a synonym for basket or car. There is no reference to the open tail of the modern balloon,

or to the importance of taking into account, in calculating ascensional power, the actual height above sea-level. "The navigational difficulties of the dirigible balloon differ little from that (*sic*) of a ship" is a statement which requires considerable qualification. Some of Santos Dumont's dirigibles and others are described in detail, but no mention is made of the chief trouble experienced by the earlier experimenters, viz., the rolling-ballast effect of the gas, which Santos Dumont overcame by using bulkheads, thus making the dirigible a practical craft.

The remaining lessons are devoted to aëroplanes, and the subject of motors and propellers appears to have been left over for subsequent lessons.

In Lesson IV. the experiments of Hanson (*sic*) are referred to, but the account is inaccurate, and there is no mention of the work of Stringfellow. The analogy of the kite, lift and drift, centre of pressure, etc., are fully explained, but the authors do not seem to have quite a clear idea as to the relations between area, weight, and speed, or to the relative advantages of the biplane and monoplane.

Lesson V. begins with various aspects of bird flight, and then passes on to the work of the pioneers. Pénaud is only given one line, though his small rubber-propelled model is of considerable historical interest; Pilcher is referred to in four lines, but there is no mention of Lilienthal. Bastin's wing-flapping machine has 11 lines devoted to it, though it was only an unsuccessful model. Ader's "Avion" is described, and the early gliding experiments of the Brothers Wright are briefly dealt with, but no reference is made to Langley, Chanute, or Ferber.

Lesson VI. relates chiefly to biplanes, but an account of Maxim's experiments is also inserted here; the Wright machine and method of launching are fully described; the explanation of the two fixed half-moon fins (between the front elevator surfaces) is, however, somewhat inadequate. Fig. 2 of the Maxim's large machine and Fig. 3 of the Wright biplane would probably be very puzzling to the student, though Fig. 7, illustrating the wing-warping system of the Wrights, is exceptionally clear.

In Lesson VII. Santos Dumont's first aëroplane is described, also the Cody machine and other aëroplanes. Mr. J. T. C. Moore-Brabazon's Voisin biplane is stated to have been "built by Messrs. Short Bros., Shellbeach." The "Clarke-Voisin" biplane is also referred to, though no machine of this type has yet been constructed. The De Dion multiplane shown at the last Paris Exhibition in October, 1909, is explained with various diagrams, though this machine was only built for purposes of advertisement.

The primary object of this course is apparently to be of assistance to those who propose to take up aëronautical engineering as a profession, and while congratulating the promoters on their enterprise it must not be forgotten that the sole *raison d'être* of such a course as this should be to impart to the student the requisite amount of knowledge in a more suitable and practical manner than by his own private study of the current literature on the subject.

Judged by these standards it can only be said that this course falls very far short of the mark aimed at, and this is to be the more regretted, inasmuch as some portions of the lessons are quite sound, and many of the accompanying diagrams well illustrate the points which they are intended to convey. The whole work is, however, very uneven; the arrangement is confusing, there are a large number of inaccuracies and misprints, and the terminology leaves much to be desired. In short, it can only be described as superficial and unpractical. Presuming that the author or authors have done their best, it is evident that they are but imperfectly acquainted with the principles of the science, and do not possess that proper perspective or true sense of proportion which would have enabled them to assign the right value to the work done by the different pioneers and experimenters in the various branches of aëronautics.

If these lessons are to render useful service for the purpose, it may be suggested that they should be entirely re-written, corrected, re-arranged, and brought up to date, the definitions of all aëronautical terms should be correctly and concisely stated, references made to various text-books, and the questions at the end of each lesson might with advantage be made more numerous and not so general in application; above all, the course should be made as practical as possible by encouraging the students to make more experiments with small paper gliders, models, etc., which are so useful in teaching the basic principles of flight; a number of lessons should be devoted to the qualities of the different materials, and their relative weights and strengths, the design of surfaces, frames, struts, joints, etc., in regard to the material used, the stresses sustained, and questions of head-resistance, etc.; the evolution of the present systems of stability and directional control

should also be clearly brought home to the mind of the student, so that he may have a good foundation to work upon, and may understand on what lines progress may be looked for in the future.

H. F. L.

Le Code de l'Air.—By Gaston Bonnefoy. 8vo., 232 pp. (M. Riviere: Paris; 1909: 3 francs 50).

Whatever opinions may be held as to the future of aërial navigation, few will deny that we are confronted with a most difficult question when we come to consider the laws which must be put in force to regulate this traffic. Although this is at the present time a subject in a very undeveloped state, yet there is even now a good deal to be said about it, especially when, as is the case with the book before us, all the legal points bearing on the case are taken into consideration. M. Bonnefoy starts with a concise statement of the laws of patents for invention, not only in France, but in other countries. Next he goes into the questions of the construction of apparatus, laws of contracts, specifications, etc. Then of buying machines, discussing contracts and agreements, and procedure when faulty construction is shown. The hiring of machines is also gone into. Laws respecting responsibility for accidents during trials, as to the use of names and infringements, and insurance of apparatus are also treated of. We then get to the important considerations of traffic in the air and landing. The question as to whether anyone is entitled to pass over private property is still an open one. Most authorities have held hitherto that the rights of ownership extend upwards without limit, but there is a big distinction between proprietorship and possession. It resolves itself rather into a matter of damage, which is often difficult to define.

The last part of the book is devoted to the intricate subject of international public rights and the passing of frontiers, first in times of peace and then during war.

This book is, of course, written for French readers, and numerous cases settled in the French Courts are quoted, showing the state of French law. We must hope soon to have a similar work on English law as it affects aëronauts.

B. B.-P.

Model Flying Machines: Their Design and Construction. By W. G. Aston (*The Aëro:* London; 1909; pp. 128; Illustrated; 1s. net).

This little book is worthy of the highest praise. The author, besides being sound in his theory and advice, is also very practical in his methods and in his instructions for carrying them out. In the matter of models the general idea with amateurs is that if they build a machine somewhat resembling a full-sized machine which has flown, and put a propeller driven by elastic or clockwork on to it, then it must fly—the only doubt being possibly as to whether the propeller is the right size. Others have some little idea which obviously (to them) gives perfect balance and stability under all conditions and will make accidents a thing of the past. The result, as the reviewer has seen in ninety-nine per cent. of cases, is a "flabby conglomeration" without a ghost of "fly" about it. All such amateurs should read this book with attention; recognise that the most successful full-sized flyers are not necessarily the best ones to copy for models; that rigidity (but not necessarily absolute fixture) is everything, as at the best the surfaces used are set at angles of only six or eight degrees, so that a slight distortion is fatal; that there is such a thing as balance and it must be at the right point; lastly, but by no means least, strength and toughness is of more value than lightness. All these and many more points Mr. Aston impresses upon his readers in his earlier chapters, and in the subsequent descriptions of his very sound types of models.

The author is evidently greatly in favour of the wooden aërofoil and simple stick frames, and gives a large selection of fine, strong models, each of which has been tried by him. At the same time there may be some who will be disappointed that he gives no examples of, say, biplanes built very lightly and braced with light steel wire. These, although they are somewhat "fine weather craft," have an added interest in being more like the well-known big machines and in being slower in their movements.

When the author treats of the other branch of model flying machines, viz., dirigible balloons, he is equally good, although, naturally, he does not treat it so fully as the more interesting branch.

A glance is taken at the helicoptere and the ornithoptere. In connection with the former the author rightly points out that "its dimensions and adjustments obey the same laws as those applying to aëroplanes." It may be noted that, contrary to popular belief, the question of stability for a helicoptere is much more troublesome than for an aëroplane.

Mr. Aston concludes with a short description of a compressed-air motor of very simple design, which, judging from the correspondence in the technical papers, should prove of great use.

In conclusion, not only would we commend this book as a *sine qua non* to all model builders, but also to those aspiring to something bigger who will find therein very sound principles in simple language.

T. W. K. C.

All the World's Airships (Aeroplanes and Dirigibles).—By Fred T. Jane (Sampson Low: London; 1909; pp. 374, 21s. net).

Mr. Jane is to be highly complimented upon his immense industry in the compilation of this book. He has undertaken a task from which all but he would shrink, and it is from no fault of his that he has fallen short of the title's high ideal. "All the World's Airships" is a gallant, even splendid, attempt to accomplish the impossible.

The aëroplanes and dirigibles of the world are ranged under the headings of the various countries, and photographs or scale drawings are reproduced, with particulars beneath each. It is to be doubted whether Mr. Jane, when he took up the work, had any conception of the immense number in existence; at the same time it seems a pity that there has been no weeding out of obvious "pelodromes," which would have materially reduced the bulk of the work. However, he has doggedly carried the task through, and we have no hesitation in affirming that the second annual issue will be even more worthy of the subject and of its author.

In a work of this kind it is imperative, particularly in the case of aëroplanes, to specialise—to remark types. In another two years it will be possible to call this annual "The World's Aërial Navies," as examples of nearly every satisfactory type of air-craft will then be Government-owned, and by adding a supplement of prominent types of private machines the work will be complete.

Part II. of the present issue contains some short articles of an undistinguished character. The exception—"Aërial Engineering," by C. de Grave Sells—is direct, lucid, and satisfactory.

We cannot congratulate the publishers on the clumsy format, or on the flimsy method of binding. Neither can we approve the proof-reader for thoroughness in his work. It is to be hoped, moreover, that such an eye-sore as the frontispiece will not be repeated. But the shortcomings of what bids fair to become an international authority are sufficiently obvious to be the salvation of future issues.

T. O'B. H.

NOTE.—Several reviews, owing to pressure on our space, are held over.—[Ed.].

FOREIGN AËRONAUTICAL PUBLICATIONS

Illustrierte Aeronautische Mitteilungen

September 22nd, 1909.—Berlin Aviation Week.—Aëroplane Types.—Orville Wright at Fort Myer.—Formula of Air-resistance.—"Hanuschke" Glider.

October 6th, 1909.—Berlin Aviation Week.—"Antoinette" Monoplane.—Grade Monoplane.—Liquid Hydrogen.—Oxygen and High Altitudes.—Obituaries of Ferber and Wellner

October 20th, 1909.—Report of Aëronautical Meeting at Frankfurt.—Gordon-Bennett Races in Zürich.—The Frankfurt Exhibition.—Propeller Tests at Frankfurt.—Rhenish-Westphalian Dirigible.—Renner Dirigible.—Grade's Monoplane.

November 3rd, 1909.—Grade Wins Lanz Prize.—Astronomical Navigation for Dirigibles—Magnetic Observations.—Balloon Compass.—Astronomical Observations.—Wireless Telegraphy.—Hamburg Aviation Week.

November 17th, 1909.—Physiological and Physical Observations in Balloon Ascents.—Oxygen and High Altitudes.—Hamburg Aviation Week.—Railway Freights for Aëroplanes and Dirigibles.

December 1st, 1909.—Obituary of Dr. Kremser.—The Leinberger Dirigible of 1835.—Meerwein's Experiments.—Kite Station at Gross-Borstal.—Construction of Wright Aëroplanes.—Aëronautical Exhibition at Linz in Austria.

December 15th, 1909.—Disaster to Balloon "Kolmar."—Milan Exhibition.—Theory of "Ballon-sonde" Ascents.—Flights by Etrich.—Wright Patents.

December 29th, 1909.—Lana and Lohmeier; Tübingen, 1784.—Speed and Ascensional Force of Dirigibles.—Rhenish-Westphalian Dirigible.—Ovid and Aëronautics.

Revue de l'Aviation

October 1909.—Aëroplane Motors.—Death of Lefebvre.—Disaster to "République."—Paris Aëro Salon.

November, 1909.—Lambert Circles Eiffel Tower.—Dirigibles.—Aërial Law.—Paris Aviation Week.

December, 1909.—Present Position of Aviation.—German Dirigibles.—Government and Aëronautics.

Wiener Luftschiffer Zeitung

October 1st, 1909.—Frankfurt Exhibition.—Death of Ferber.—Wright in Berlin.

October 15th, 1909.—Austrian Aviation Prizes.—Zürich Meeting.—Austrian Dirigibles.—Berlin Meeting.

November 1st, 1909.—Austrian Aviation Prizes.—Zürich Meeting.—Renner Dirigible.—Blériot in Vienna.

November 15th, 1909.—Austrian Aviation Prizes.—Naval Dirigibles.

December 1st, 1909.—Austrian "Parseval."—Austrian Aëroplanes.—Dirigibles in 1909.

December 15th, 1909.—Austrian "Parseval."—Methods for Determining Air-Resistance.

Bollettino della Societa Aeronautica Italiana

October-November, 1909.—Prevalent Wind System in Italy (concluded).—Method of Determining the Relative Efficiency of Various Dirigibles.—Circulation of the Atmosphere.—Fourth Aëronautical Conference (Nancy).—Brescia Meeting.—Italian, French, and German Military Dirigibles.

The American Aeronaut

October, 1909.—Rheims Meeting.—Atmospheric Waves.—Firearms on Airships.—"Parseval" Dirigible.—Gibson's Theory of Aërial Viscosity.—How to Learn to Fly (by O. Chanute).

Aeronautics (U.S.A.)

October, 1909.—The Wrights' Action.—Peoria Balloon Race.—Constructional Aids.—Sellers' Aëroplane.—Rheims Meeting.

November, 1909.—Wright-Curtiss Action.—Constructional Aids.—Wrights' Propeller Efficiency.—Hudson-Fulton Celebrations.

December, 1909.—Constructional Aids.—American Dirigibles.

Aerophile

October 1st, 1909.—Paris Aëro Salon.—The "Demoiselle."—Death of Ferber.—Disaster of the "République."—German Dirigibles.—Gordon-Bennett Race at Zürich.

November 1st, 1909.—Lambert Circles the Eiffel Tower.—Juvisy Aviation Meeting.—Principal Aëroplanes.—Experimental Laboratory.—Practical Utility of the Aëroplane.—Aërial Photo-Topography.

November 15th, 1909.—Blackpool and Doncaster Meetings.—Aviation in the French Navy.—The "Zodiac III."—German Dirigibles.

December 1st, 1909.—The Swoop of the Hawk.—Bird-Flight.—German Dirigibles.—Aërial Photo-Topography.

December 15th, 1909.—Death of Fernandez.—Construction of Propellers.—Aërial Photo-Topography.

Aeronaute

October 16th, 1909.—Lift of Curved Surfaces.

October 23rd, 1909.—Lambert's Flight Round Eiffel Tower.—Boucheron Aëroplane.

November 20th, 1909.—Ader's Patents.—Bird-Flight.

November 27th, 1909.—Bird-Flight.

December 4th, 1909.—Bird-Flight.—French Government and Aviation.

December 11th, 1909.—New Wright Patents.

December 18th, 1909.—Death of Fernandez.—Soaring Flight.—Automatic Stability.

January 1st, 1910.—Soaring Flight.—Clément-Bayard Biplane.

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